CSP# 2026-08

PROJECT MANUAL – VOLUME 1 OF 2

Creekwood and Riverwood Middle School Additions and Renovations

Humble Independent School District

Humble, Texas

Huckabee | MORE THAN ARCHITECTS

CSP# 2026-08

MORE THAN ARCHITECTS

PROJECT MANUAL

Project Name:	Creekwood and Riverwood Middle School Additions and Renovations – Volume 1 of 2		
Client Name:	Humble Independent School District	Location:	Humble, Texas
Project Number:	1821-13-01,02	Date:	October 29, 2025

All inquiries shall be forwarded to Ross Morgan, Huckabee; rmorgan@huckabee-inc.com; 800.687.1229.

PROJECT TEAM



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713.333.0119



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MECHANICAL/ELECTRICAL/TECHNOLOGY/ PLUMBING ENGINEER:
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Melissa Moore

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END OF SECTION

SECTION 00 2116
INSTRUCTIONS TO PROPOSERS

INSTRUCTIONS TO PROPOSERS - CSP# 2026-08

1.01 RECEIPT AND OPENING OF PROPOSALS

A. Competitive sealed proposals will be received from qualified Proposers in care of Dr. Roger Brown, Superintendent of Schools, Humble ISD, Humble, Texas. The Proposal responses shall be received via Humble ISD's online bidding system in two parts follows: Base Bid of the Proposal shall be received until 1:00 PM, THURSDAY, THURSDAY, JULY 23, 2026 and Alternates of the Proposal shall be received until 2:00 PM, THURSDAY, JULY 23, 2026. All proposals must be submitted via the District's online bidding system, before the scheduled time and date for proposal opening. Proposers are to have all forms, required attachments, and all required lines completed and the **SUBMIT RESPONSE** button completed prior to 2:00 PM, THURSDAY, JULY 23, 2026 or the system will shut them out and no response will be submitted. Please plan ahead. Proposal responses will be opened and read aloud for the furnishing of all labor, materials, equipment, and performing all work required for Creekwood and Riverwood Middle School Additions and Renovations for Humble ISD, Humble, Texas, and in compliance with Project Manual, drawings, and other contract documents as prepared by Huckabee.

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 once board approval has been obtained.

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. **There will be a Pre-Proposal Meeting held at 10:00 am, Wednesday, July 8, 2026 , at Humble ISD Maintenance Department, 1703 Wilson Road, Building B, Humble, Texas 77396. Attendance is highly recommended.**
   1. Campus tours will occur immediately following the Pre-Proposal Meeting.

F. The Bid Opening Meeting will be held at 3:00 pm, Thursday, July 23, 2026 at Humble ISD Child Nutrition Facility, 1703 Wilson Road, Humble, Texas 77396, Building D, Room 100, or via zoom. Attendance is not required.
   1. ZOOM Meeting Information:
      a. https://humbleisd.zoom.us/j/88903394463

1.02 PREPARATION OF PROPOSAL

A. The latest version of the A305 Document must be accompanied by a listing of the Offeror's projects of similar size and scope during the past five (5) years. The listing shall include the project name, address, building area, contract sum, contract date, contract completion date(s), substantial completion date(s), Owner representative's name, telephone number, e-mail address and the names of the Contractor's project staff assigned to the project. In addition, the General Contractor shall include in this submission the following information regarding the Contractor's Proposed Project Team:
   1. Name of the Proposed Project Executive.
   2. Name of the Proposed Project Manager.
   3. Names of Proposed Assistant Project Managers or Project Engineers.
   4. Name of Proposed Project Superintendent.
   5. Name of Proposed Assistant Project Superintendent.
   6. Name of Proposed Field Engineer.

7. Names of any proposed project support staff.

B. The General Contractor shall include a resume of qualifications for each of the project personnel proposed.

C. In addition, include a written summary describing the roles each person will have on the project team and what percentage of time each person will dedicate to this project on a weekly basis. In addition, the contractor shall indicate where each staff member will office (onsite or main office).

D. **A pdf copy of the A305 should be uploaded with Offeror's proposal on District's online proposal system. Obtain and submit the latest version of the document.**

E. The Proposer shall complete Proposal Form 00 4200 on Line Items tab through Districts' bidding system. The Proposer's CSP response shall be completed online and will consist of the following:
1. Section 00 4200 - responses on Line item.
2. Cashier's check, Certified check or District acceptable Bid Bond for no less than five (5%) percent of the largest possible total for response submitted - uploaded to Response Attachment tab Section 00 4214.10.
3. Acknowledgement of any Addendum issued (on Attributes tab).
4. Construction Schedule - Section 00 4335
5. Provide Subcontractor's List - Section 00 4335

F. The successful Proposer will be required to enter into a contract with the Humble ISD and to furnish a Performance and Payment Bond of approved form through an approved bonding company duly authorized to do business in the State of Texas, and currently listed in the Department of Treasury Federal Register, in the amount of not less than 100% of the contract price, conditioned upon the performance of the contract. Performance and Payment Bonds shall be in full compliance with Texas Government Code Chapter 2253. AIA Bonds (AIA Document A312) do not comply. Bonding Companies using “Reinsuring Insurance Companies” to expand the Bonding Companies Bonding Limits will not be acceptable unless also approved by the Owner.

1.03 WAGE RATES

A. Attention is called to the fact that the Contractor must comply with all Federal, State and Local labor laws, including Chapter 2258 Texas Government Code Title 10, which requires that the Contractor pay not less than the following prevailing wage rates and rates for legal holidays and overtime, which have been ascertained by the awarding body and listed in Section 00 7343 - Wage Rate Requirements.

1.04 DISCLOSURE OF INTERESTED PARTIES

A. Please download the Instructions for Form 1295, execute and upload the completed Form 1295 on the Response Attachments tab of the online bidding system.

B. Failure to upload completed Form 1295 will disable the SUBMIT RESPONSE button. It is Humble ISD requirement to have this form with each CSP response.

1.05 PROPOSAL GUIDELINES

A. Attention is called to the fact that the Owner is exempt from the payment of the State Sales Tax normally levied against material costs. The contract sum, as identified by the Proposal, shall not include any allowance for the payment of State Sales Tax on materials required to complete the work. The successful Proposer, upon award of the contract, will be furnished with a permit number, which will enable him to purchase the required materials without payment of such taxes.

B. The Project Manual and Drawings may be examined, without charge, via Electronic Documents (PDF Files) downloaded at www.huckabee-inc.com.

C. The Architect will supply Project Manual and Drawings to various plan rooms where it appears to be in the Owner's interest to do so.

D. All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, and the Supplementary General Conditions included in the Project Manual are applicable to the Instructions to Proposers.

E. Contract Documents include the Advertisement or Invitation for Proposal, Instructions to Proposers, the Proposal Form, and the proposed contract documents (drawings and project manual), including any addenda issued prior to receipt of competitive sealed proposals.

F. Certain references to Owner’s Documents will be obsolete due to the new online bidding procedure of submission of proposal and forms through Humble ISD’s online bidding system. Offerors intending to submit proposals for this project should visit the website for Humble ISD at http://humbleisd.ionwave.net/Login.aspx to register and access all of the Owner’s required forms, certifications and enter Base Proposal, Alternates Proposal, Unit Pricing and other required items.

G. Addenda are written or graphic instruments issued prior to the execution of the contract which modify or interpret the proposal documents, including drawings and project manual, by additions, deletions, clarifications or corrections and should be acknowledged by the Proposer on the Proposal form. Addenda will become part of the contract documents when the construction contract is executed. All project ADDENDA will be issued through the Districts' online bidding system. Interested proposers should be registered in order to receive these Addenda. It is Proposers' responsibility to check the project for Addenda issued and review the Questions tab for the project. NO ADDENDA WILL BE MAILED OR FAXED TO ANY PLANHOLDER.

H. Each Proposer, by making a competitive sealed proposal, represents that he has carefully studied, compared, and understands the contract documents including any and all addenda items.

I. Each Proposer, by making a competitive sealed proposal, represents that he has familiarized himself with and understands the local conditions under which work is to be performed, including prevailing subsurface conditions.

J. All Competitive Sealed Proposal (CSP) responses must be sumitted with all other required material in accordance with the Instructions to Proposers - 00 2116. When the proposal contains multiple "Bid Items", it shall be understood that the Owner may award each Proposal Item separately, or in any combination that the Owner chooses.

K. A proposal is invalid if it has not been deposited at the designated location prior to the time and date for receipt of proposals indicated in the Advertisement or Invitation for Proposal or prior to any extension thereof issued to the Proposers.

L. Unless otherwise provided in any supplement to the Instruction to Proposers, no Proposer shall modify, withdraw or cancel his proposal or any part thereof for sixty (60) days after the time designated for the receipt of proposals in the Advertisement or Invitation for Proposal.

M. Each Proposer represents that his competitive sealed proposal is based upon the material and equipment described in the contract documents.

N. Each Proposer shall carefully study and compare the proposal documents, and shall make request for interpretation or correction of any ambiguity, inconsistency or error therein which he may discover. All questions and are to be asked in IonWave "Questions" tab by 3:00 pm, July 13, 2026. Any interpretation or correction will be issued in a written addendum by the Architect and distributed via the Districts' online bidding system to registered/invited General Contractors. Only a written interpretation or correction by an addendum shall be binding. No Proposer shall rely upon any interpretation or correction given by any other method.

O. No substitution will be considered unless written request has been submitted to the Architect for approval at least seven (7) days prior to the date for receipt of proposals. Each such request shall include a complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete evaluation.

P. If the Architect approves any proposed substitution, such approval will be set forth in a written Addendum issued by Architect and distributed via the Districts' online bidding system to registered/invited General Contractors.

Q. Should the particular equipment, which any bidder proposes to install, require other space conditions other than those shown on the drawings, he shall arrange for such space with the Architect before submitting a bid. Should changes become necessary because of failure to comply with this requirement, the contractor shall be fully responsible for making such changes. The contractor shall be required to submit working drawings of all equipment, which varies from the drawings and the project manual, and any interference must be eliminated before work proceeds.

R. The Proposer acknowledges the right of the Owner to reject any or all proposals and to waive any informality or irregularity in any proposal received. In addition, the Proposer recognizes the right of the Owner to reject a proposal if the Proposer failed to furnish any required bid security or to submit the data required by the contract documents, or if the proposal is in any way incomplete or irregular.

S. By submitting a proposal, each proposer agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal; waiver of any requirements under the Bid Documents; or the Contract Documents; acceptance or rejection of any proposals; and award of the Contract.

T. In case of ambiguity or lack of clearness in stating the price in the Proposal, the Owner reserves the right to adopt the price written in words or to reject the Proposal.

PROPOSAL EVALUATION PROCESS AND PROCEDURES

2.01 COMPETITIVE SEALED PROPOSAL EVALUATION AND RANKING PROCEDURES

A. The following procedures shall be used to evaluate and recommend a construction contractor for selection by the School District through the use of Competitive Sealed Proposals, as authorized in Texas Government Code 2269.

2.02 PROPOSAL EVALUATION COMMITTEE

A. For each construction project utilizing the Competitive Sealed Proposal method of procurement, the School Board shall convene a Proposal Evaluation Committee (Committee) may be comprised from of the following individuals:
   1. School Board Members
   2. School Administration
   3. District’s Financial Officer or Consultant
   4. Staff
   5. Project Architect
   6. Project Engineer
   7. Program Manager

2.03 PROPOSAL EVALUATION COMMITTEE FUNCTION

A. The Committee shall perform an evaluation of all submitted Proposals and shall recommend an order of selection ranking of all Proposers to the School Board. The following procedures shall be used by the Committee in the evaluation process:

1. Proposals are to include the information requested in this of this Request in the sequence and format prescribed. In addition to and separate from the requested information, offerors submitting proposals may provide supplementary materials further describing their capabilities and experience.
2. Following the deadline for receipt, the District's staff will receive, publicly open, and read aloud the names of the offerors and, if any are required to be stated, all prices stated in the proposals. The District's staff will recommend that the District select a construction contractor from the respondents to this Request for Proposals or reject all proposals.
3. The recommended ranking shall be based on the data furnished by the offerors in response to the request for CSPs. The following is a list of criteria and weight for each criterion. Unless modified by addendum prior to opening of the proposals, the following listing of criteria and weight of criteria shall be utilized by the District pursuant to Texas Government Code Chapter 2269, Subchapter D:

Evaluation Criteria	Max Score: 100 points	All Criteria Scores
1. Extent of the firm's experience in the construction/renovation of educational facilities of comparable size and complexity in the greater Houston area construction market. Location/Page #_____	15 points	
2. Whether the team personnel proposed have the appropriate experience and capabilities for the project. Also provide the proposed team's current commitments. Location/Page #_____	10points	
3. Whether the firm has demonstrated the capability to meet project schedules and budgets. Provide the following project information for the last 5 years: original contractual completion date, original contract amount and final contract amount. Location/Page #_____	10 points	
4. How long the firm has been in business, and whether the firm's organizational structure, licensing and financial information indicate that the firm is capable of successfully completing this project. Location/Page #_____	10points	
5. The firm's responsiveness and completeness regarding the Request for Qualifications submittal. Location/Page #_____	5 points	
6. The firm's safety and drug abuse programs, and history of safety performance. Location/Page #_____	3 points	
7. Whether the firm has previously worked for the District, and whether the work was satisfactory to the District. Location/Page #_____	2 points	
8. Responses from the firm's references. Do not enter score on this sheet. Score will be inserted on summary sheet. Location/Page #_____	5 points	
9. Price. Location/Page #_____	40 points	
Grand Total Score:	**100**	

4. All responses in the proposal may be used to help the District select a contractor based on these criteria. The District reserves the right to verify the accuracy and completeness of all response by utilizing any information available to the District without regard to whether such information appears in the proposal. See Selectoion Criteria and Contrator Information Sheet attached following this document.

2.04 COMPETITIVE SEALED PROPOSALS PREPARATION AND SUBMISSION

A. PREPARATION
1. The Proposal shall be based on conditions at the project site, the project Drawings and Specifications and any addenda issued.
2. A Proposal showing omissions, alterations, conditions, or carrying riders or other qualifiers, which modifies the Proposal, may at the Owner's discretion, be rejected as irregular.

B. SUBMISSION
1. If the Proposer chooses to issue a "No Response" (Enter "0" in the Online System) to a question on the Proposal, an explanation of this action is required. Failure to provide an adequate explanation may be viewed by the Owner as an incomplete response and may subject the entire Proposal to rejection or at a minimum a score of zero (0) will be given for that category.
2. Only one Proposal may be submitted by each Proposer.
3. Proposals not submitted prior to published or amended Response date/time will not be accepted by the Districts' online bidding system. Responders will be locked out of their response and their response will be incomplete.
4. A Proposer will receive no compensation or reimbursement of expenses incurred in of the preparation of a Competitive Sealed Proposal submission.
5. The Owner reserves the right to reject any or all Proposals, and waive any and/or all formalities.

2.05 PUBLIC INFORMATION AND NOTICE OF CONFIDENTIALITY

A. The Owner considers all Proposal information, documentation and supporting materials submitted in response to this Proposal request to be non-confidential and/or non-proprietary in nature, and therefore, shall be subject to the public disclosure under the Texas Public Information Act (Texas Government Code, Sec. 552.001, et seq.) after the award of the contract. See ATTRIBUTES Tab in Districts' online bidding system.

B. The Proposer must identify and designate those portions of their technical Proposal that contains trade secrets or other proprietary data. If the Proposal includes such data, the Proposer shall. See ATTRIBUTES Tab in Districts' online bidding system.
1. Mark the cover sheet of the Technical Proposal with the following phrase: "This Proposal includes data that shall not be disclosed outside the School District and the A/E design team and shall not be duplicated, used or disclosed in whole or in part for any purpose other than to evaluate the Proposal."
2. Mark each sheet and the specific data on that sheet that the Proposer wishes to restrict with the following phrase: "Use or disclosure of the specifically marked data is subject to the restrictions regarding confidentiality cited on the cover sheet of this Proposal."

2.06 OWNERSHIP OF COMPETITIVE SEALED PROPOSAL

A. Submitted Proposals, documentation and supporting material shall become the property of the Owner.

2.07 SITE INVESTIGATION

A. It is the responsibility of each Proposer to examine the project site, existing improvements and adjacent property and be familiar with existing conditions before submission of Proposal.

B. After investigating the project site and comparing the Project Manual and Drawings with the existing conditions, the Proposer should immediately notify the A/E of any conditions for which requirements are not clear, or about which there is any question regarding the extent of the work involved.

C. Should the successful Proposer fail to make the required investigation and should a question arise after award of the contract as to the extent of the work involved in any particular case, after receiving recommendations from the A/E, the Owner will make the interpretation of the Contract Documents.

2.08 EVALUATION AND CONTRACT AWARD PROCESS

A. Proposals will be opened publicly to identify the names of the Proposer and their respective proposed contract amount. Other contents of the Proposals will be afforded security sufficient to preclude disclosure of the contents prior to award or rejection action.

B. Proposals will be evaluated by the Proposal Evaluation Committee as set forth in 2.02.A. The criteria for evaluation and selection of the successful Proposer for this award will include the factors listed in 2.03.A.4.

C. Within sixty (60) calendar days after opening the Proposals, the Owner will evaluate and rank each Proposal with respect to the published selection criteria described under Paragraph 2.03. After opening and ranking, an award may be made on the basis of the initially submitted Proposal, without discussion, clarification or modification, or the Owner may discuss with the selected Proposer any element of the Proposal. Other than the data read at the Proposal opening, the Owner shall not disclose any information derived from the Proposals submitted by competing firms in conducting such discussions. If the Owner determines that it is unable to reach a satisfactory agreement with the first ranked Proposer, the Owner will terminate discussions with that Proposer. The Owner will then proceed with negotiations with each successive Proposer as they appear in the order of ranking until an agreement is reached, or until the Owner has rejected all Proposals. After termination of discussions with any Proposer, Owner will not resume discussions with that Proposer.

D. The Owner reserves the right to accept or reject any or all alternates or to accept any combination of alternates considered advantageous to the Owner.

E. The award or rejection action regarding this Proposal is at the sole discretion of the Owner and the Owner makes no warranty regarding this Proposal that a contract will be awarded to any Proposer.

F. The Owner agrees that if the Contract is awarded, it will be awarded to the Proposer offering the best value to the Owner, based upon the published selection criteria, and upon its ranking evaluation. The Owner is not bound to accept the lowest priced Proposal if that Proposal is judged not to be the best value for the Owner, as determined by the Owner.

G. No work may begin without the receipt of District Purchase Order, no exceptions.

END OF SECTION

SECTION 00 3126
EXISTING HAZARDOUS MATERIAL INFORMATION

PART 1 - GENERAL

1.01 INVESTIGATION

A. Investigations of hazardous materials within the facilities was authorized by the Owner and conducted for the referenced facilities. The documents are provided by the Owner as information for Bidders' convenience and are intended to supplement the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. The Architect takes no responsibility whatsoever for the services performed by the environmental consultant, for any breach of contract of the environmental consultant, nor the content, accuracy, negligence, errors or omissions of the environmental consultant's project documents. Furthermore, the Architect is not in charge of the environmental consultant, and has no responsibility for coordinating the services or project documents of the environmental consultant.

1.02 REPORT

A. The existing Hazardous Material Investigations current and previous reports are attached following this page for the contractors reference.
   1. Loflin Environmental Services, Inc., dated March 28, 2024.
   2. Loflin Environmental Services, Inc., dated February 13, 2024.

B. Reports are available for Contractor's information but is not a warranty of existing conditions, nor is it a part of the Contract Documents.

1.03 RESPONSIBILITY

A. Bidders are expected to examine the site and investigation reports and then decide for themselves the character of the materials to be encountered.

B. The Owner and Architect assume no responsibility for variations, quality or conditions.

C. The Owner and the Architect assume no responsibility for any conclusions or interpretations made on the basis of information contained in the provided documents.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

CSP# 2026-08

LOFLIN ENVIRONMENTAL SERVICES, INC.

March 28, 2024

Ms. Leigh Ann Johnson
Humble ISD Support Services Division
P.O. Box 2000
Humble, Texas 77347

AHERA ASBESTOS INSPECTION
CREEKWOOD MIDDLE SCHOOL
3603 W. LAKE HOUSTON PKWY.
KINGWOOD, TEXAS

INTRODUCTION

Loflin Environmental Services, Inc. performed an EPA required AHERA inspection of the Creekwood Middle School building, located at 3603 W. Lake Houston Pkwy. in Kingwood, Texas on January 24, March 12 and March 28, 2024. The inspection was performed by Mr. Michael Hendrix & Mathew Songster, an EPA accredited and Texas DSHS licensed asbestos inspector in general accordance with the requirements of 40 CFR Part 763, Subpart E, Section 763.85(b).

The purpose of the inspection was to:

- Identify all friable and non-friable asbestos containing materials.
- Observe and touch all suspect materials, identifying those materials, and either sampling or assuming suspect materials to contain asbestos.
- Sample locations will be documented on a legible drawing of school building.
- Any materials resulting as asbestos containing will be documented on a drawing and quantified.
- A condition assessment will be provided for all asbestos containing materials.

LIMITATIONS

Inaccessible areas, such as wall cavities, pipe chases, flooring under carpeting, and above sheetrock or plaster ceilings and outside the building do not fall within the scope of an AHERA asbestos inspection.

FACILITY DESCRIPTION

The Creekwood Middle School consists of an approximately 145,000 square foot one-story building, which was constructed in 1981. The building construction consists of a steel beam frame with brick veneer over a concrete foundation. The interior walls are

sheetrock. The floors are covered with ceramic floor tile, vinyl floor tile, floor coating or carpet. The ceilings consist of sheetrock and lay-in ceiling tile. Heating and air conditioning are supplied by HVAC units and distributed through fabricated sheet metal ducts with fiberglass insulation.

HOMOGENOUS MATERIALS

- Laminate flooring
- 12” x 12” Green Floor Tile
- 12” x 12” White Floor Tile
- 12” x 12” Black Floor Tile
- 12” x 12” White w/ blue Floor Tile
- Sheetrock/Joint Compound
- Cove Base Mastic
- 2’ x 2’ Lay-in Ceiling Tile
- 2’ x 2’ Sheetrock Ceiling Tile
- 1’ x 1’ Ceiling tile
- Gray HVAC duct mastic
- White HVAC duct mastic
- Spray-on Fireproofing
- Vapor barrier mastic
- Roof cap caulking
- Main core roof
- Chill water supply and return
- Hot water supply and return
- Domestic water line
- Expansion joint caulking
- Carpet Glue w/ black mastic
- Yellow Carpet glue
- CMU texture

SUMMARY OF FINDINGS

Based on laboratory analysis, the following materials were found to contain asbestos.

Black floor mastic was found to contain 2-5% Chrysotile asbestos. The asbestos containing black floor mastic was observed throughout the building under floor tile, carpet and laminate flooring. Walkthrough verification revealed the material in the following areas, Rooms 103, 101, 108, 106, 104, 102, 301, 303, 305, 307, TP 300 hall, TP 500 Hall, 504, 505, 700B, 701, 703, 202, 204, 205, 206, TP 200 Hall, TP 400 hall, TP 600 hall, 902, 904, 903, Main office restrooms, Teachers lounge, Conference Office, Clinic, Printer room, Break room, Library offices, Orchestra, and Floor tiled Gym. Approximately 50,000 Sq. Ft.

Black vapor barrier mastic was found to contain 5-7% Chrysotile asbestos. The asbestos containing black vapor barrier mastic was observed behind exterior brick at the rear of the building. Approximately 54,000 Sq. Ft.

- ***It will be the Contractor's responsibility to confirm asbestos material quantities prior to material disturbance. There will be no discussion regarding specified asbestos material quantities after commencement of work.***

According to 2020 AHERA reinspection report, TSI that is enclosed in pipe chases and wall cavities is considered to be Asbestos Containing Material

Any Area's containing black floor mastic are considered Asbestos Containing Material

RECOMMENDATIONS

Humble I.S.D. must maintain a copy of this report with the Asbestos Operations and Maintenance (O & M) file and at the location of the Creekwood Middle School. Any suspect materials discovered during renovation or demolition activities that were not addressed in this report should be promptly tested for asbestos content by a Texas DSHS licensed asbestos inspector.

A listing of homogeneous materials that were sampled and bulk sample locations with a drawing of the school building is included in this report.

Should you have any questions regarding this report, please contact us at (713) 521-3300

Kind Regards,

Michael Hendrix
Texas DSHS Inspector #602838

HOMOGENEOUS MATERIALS/BULK SAMPLE LOCATIONS

- **Carpet glue w/ black mastic**
  - 01 – Choir practice room 1
  - 02 – Choir practice room 1
  - 03 - Band practice room 2
- **Cove base mastic**
  - 04 – Band hall storage
  - 05 – Culinary arts room
  - 06 – CTE
- **CMU texture**
  - 07 – Band hall
  - 08 – Band hall
  - 09 – Band hall storage
  - 10 – Choir room
  - 11 – Choir room

12 – Choir room storage
13 – Culinary arts

- **Laminate flooring**
  14 – Band hall
  15 – Band hall
  16 – Band hall
- **2’ x 2’ white ceiling tile**
  17 – Music room
  18 – Culinary arts room
  19 – CTE
- **2’ x 2’ sheetrock ceiling tile**
  20 – Choir room
  21 – Band hall
  22 – Choir room
- **1’ x 1’ Ceiling tile**
  23 – Choir practice room 1
  24 – Choir practice room 1
  25 – Choir practice room 2
- **Wallboard system**
  26 – Choir room
  27– Choir room
  28 – Choir room
  29 – Band hall
  30 – CTE
  31 – CTE
  32 – Culinary arts room
- **12” x 12” Green floor tile w/ black mastic**
  33 – Band hall
  34 – Band hall
  35 – Band hall
- **Spray-on fire proofing**
  36 – Band hall
  37 – Band hall
  38 – Choir room
  39 – Choir room
  40 – Choir room
  41 – CTE
  42 – Culinary arts room
- **Gray duct mastic**
  43 – CTE electrical closet
  44 – CTE electrical closet
  45 – CTE electrical closet
- **White duct mastic**

46 – CTE
47 – CTE
48 – CTE

- **12” x 12” White floor tile w/ black mastic**

49 – CTE office area
50 – CTE office area
51 – CTE office area

- **12” x 12” Black floor tile w/ black mastic**

52 – CTE
53 – CTE
54 – CTE

- **12” x 12” Black floor tile w/ black mastic**

55 – CTE office area
56 – CTE office area
57 – CTE office area

- **12” x 12” White floor tile w/ black mastic**

58 – Culinary arts pantry
59 – Culinary arts storage
60 – Culinary arts main

- **Vapor barrier mastic**

01B – Rear of building

- **Roof cap caulking**

02B – Roof

- **Main core roof**

03B – Roof

- **Chill water supply**

04B – Culinary Hall
05B – Gym Mechanical room
06B – Band Hallway

- **Chill water return**

07B– Culinary Hall
08B– Gym Mechanical room
09B –Band hallway

- **Hot water supply**

10B – Culinary Hall
11B – Gym Mechanical room
12B – Band Hallway

- **Hot water return**

13B– Culinary Hall
14B– Gym Mechanical room
15B –Band hallway

- **Expansion joint caulking**

16B – Rear of building

- **Domestic water line**
  17B– Culinary Hall
  18B– Culinary Hall
  19B – Culinary Hall

Additional Samples 3-14-24

- **Black floor mastic**
  01– 700B
  02– 701
  03– 703
  04– 500TP
  05– 301
  06– 303
  07– 307
  08– 202
  09– Clinic
  10– Conference office
- **Yellow carpet glue**
  11– Library
  12– Theater
  13– 501
  14– 404
  15– 601
  16– 603
  17– Front office

Additional Samples 3-28-24

- **Yellow carpet glue**
  01– 705
  02– 707
  03– 709
  04– 502
  05– 504
  06– 506
  07– 508
  08– 505
  09– 503
  10– 507

11– 302
12– 304
13– 306
14– 308
15– 310
16– 100
17– 208
18– 201
19– 203
20– 205
21– 207
22– 402
23– 404
24– 406
25– 408
26– 410
27– 401
28– 403
29– 405
30– 407
31– 602
32– 604
33– 606
34– 608
35– 610
36– 605
37– 607

- **Black floor mastic**

38– Orchestra
39– 906
40– 505
41– 305
42– 102
43– 104
44– 106
45– 108
46– 101
47– 205
48– 200TP
49– 400TP
50– 600TP
51– Cafeteria
52– Library offices

53– Copy room
54– Office R/R
55– Office Break room
56– Clinic
57– 204
58– Media production-library

- **Yellow carpet glue**

59– Front office south side
60– Front office north side
61– Principal office area
62– Stage storage
63– Stage

- **Black floor mastic**

64– Seminar work room
65– Periodicals
66– Library offices

- **Yellow carpet glue**

67– Mrs. Griph office
68– Conference office
69– Principal assistant office

- **Black floor mastic**

70– 3D printer room
71– Dark room

- **Yellow carpet glue**

72– Middle office area

Flooring Sample Locations

Sample Number	Date	Location	ACM
01	1/24/24	Choir Practice room 1	YES
02	1/24/24	Choir Practice room 1	YES
03	1/24/24	Band Practice room 2	YES
15	1/24/24	Band Hall	YES
16	1/24/24	Band Hall	YES
33	1/24/24	Band Hall	YES
34	1/24/24	Band Hall	YES
35	1/24/24	Band Hall	YES
58	1/24/24	Culinary arts pantry	YES
59	1/24/24	Culinary arts storage	YES
60	1/24/24	Culinary arts main	YES
01	3/14/24	700B	YES
02	3/14/24	701	YES
03	3/14/24	703	YES
04	3/14/24	500TP	YES
05	3/14/24	301	YES
06	3/14/24	303	YES
07	3/14/24	307	YES
08	3/14/24	202	YES
09	3/14/24	Clinic	YES
10	3/14/24	Conference office	YES
11	3/14/24	Library	NO
12	3/14/24	Theater	NO
13	3/14/24	501	NO

Sample Number	Date	Location	ACM
14	3/14/24	404	NO
15	3/14/24	601	NO
16	3/14/24	603	NO
17	3/14/24	Front office	NO
01	3/28/24	705	NO
02	3/28/24	707	NO
03	3/28/24	709	NO
04	3/28/24	502	NO
05	3/28/24	504	NO
06	3/28/24	506	NO
07	3/28/24	508	NO
08	3/28/24	505	NO
09	3/28/24	503	NO
10	3/28/24	507	NO
11	3/28/24	302	NO
12	3/28/24	304	NO
13	3/28/24	306	NO
14	3/28/24	308	NO
15	3/28/24	310	NO
16	3/28/24	100	NO
17	3/28/24	208	NO
18	3/28/24	201	NO
19	3/28/24	203	NO
20	3/28/24	205	NO
21	3/28/24	207	NO
22	3/28/24	402	NO
23	3/28/24	404	NO

Sample Number	Date	Location	ACM
24	3/28/24	406	NO
25	3/28/24	408	NO
26	3/28/24	410	NO
27	3/28/24	401	NO
28	3/28/24	403	NO
29	3/28/24	405	NO
30	3/28/24	407	NO
31	3/28/24	602	NO
32	3/28/24	604	NO
33	3/28/24	606	NO
34	3/28/24	608	NO
35	3/28/24	610	NO
36	3/28/24	605	NO
37	3/28/24	607	NO
38	3/28/24	Orchestra	YES
39	3/28/24	906	YES
40	3/28/24	505	YES
41	3/28/24	305	YES
42	3/28/24	102	YES
43	3/28/24	104	YES
44	3/28/24	106	YES
45	3/28/24	108	YES
46	3/28/24	101	YES
47	3/28/24	205	YES
48	3/28/24	200TP	YES
49	3/28/24	400TP	YES
50	3/28/24	600TP	YES

Sample Number	Date	Location	ACM
51	3/28/24	Cafeteria/GYM	YES
52	3/28/24	Library Offices	YES
53	3/28/24	Copy Room	YES
54	3/28/24	Office R/R	YES
55	3/28/24	Office Break room	YES
56	3/28/24	Clinic	YES
57	3/28/24	204	YES
58	3/28/24	Media production-library	YES
59	3/28/24	Front office south side	NO
60	3/28/24	Front office north side	NO
61	3/28/24	Principal office area	NO
62	3/28/24	Stage storage	NO
63	3/28/24	Stage	NO
64	3/28/24	Seminar work room	YES
65	3/28/24	Periodicals	YES
66	3/28/24	Library offices	YES
67	3/28/24	Mrs. grigh office	NO
68	3/28/24	Conference office	NO
69	3/28/24	Principal Assistant	NO
70	3/28/24	3D printer room	YES
71	3/28/24	Dark room	YES
72	3/28/24	Middle office	NO

CSP# 2026-08



Black Floor Mastic

Yellow Floor Mastic/ Non-ACM

Black Vapor Barrier Mastic

V Floor Tile

C Carpet

LOFLIN Environmental Services, Inc. 2020 Montrose Blvd., Suite 100 Houston, Tx 77006 (713)351-1301/(713)494-4442	**Approximate Sample Location Diagram** ***Client: Humble ISD**	**Creekwood Elementary** **3603 W. Lake Houston Pkwy.** **Kingwood, Texas** **Job # 62-23-27**

CSP# 2026-08 **Loflin Environmental Services, Inc.** 2020 Montrose Blvd., Houston, Texas 77006
(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385219*	01	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		3-5% CHRYSOTILE	TAR
L385220*	02	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		3-5% CHRYSOTILE	TAR
L385221*	03	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		3-5% CHRYSOTILE	TAR
L385222	04	WHITE, GUMMY NONHOM (COVE BASE MASTIC)		NONE DETECTED	OTHER
		TAN, CRUMBLY (COVE BASE MASTIC)		NONE DETECTED	OTHER
L385223	05	WHITE, GUMMY NONHOM (COVE BASE MASTIC)		NONE DETECTED	OTHER
		TAN, CRUMBLY (COVE BASE MASTIC)		NONE DETECTED	OTHER
L385224	06	WHITE, GUMMY NONHOM (COVE BASE MASTIC)		NONE DETECTED	OTHER
		TAN, CRUMBLY (COVE BASE MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

*Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.
Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
Analysis results on this test report pertain only to those materials tested.
Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385225	07	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385226	08	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385227	09	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385228	10	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385229	11	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385230	12	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER
L385231	13	WHITE, CRUMBLY HOMOGENEOUS (CMU TEXTURE)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: ***None***
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Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385232	14	LT. BROWN, ELASTIC NONHOM (FLOORING)		NONE DETECTED	OTHER
		CLEAR, GUMMY (MASTIC)		NONE DETECTED	OTHER
		GRAY, CRUMBLY (FLOAT)		NONE DETECTED	OTHER
L385233*	15	LT. BROWN, ELASTIC NONHOM (FLOORING)		NONE DETECTED	OTHER
		CLEAR, GUMMY (MASTIC)		NONE DETECTED	OTHER
		WHITE, GRANULAR (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		3-5% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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EPA 600/R-93/116, July 1994
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Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385234*	16	LT. BROWN, ELASTIC NONHOM (FLOORING)		NONE DETECTED	OTHER
		CLEAR, GUMMY (MASTIC)		NONE DETECTED	OTHER
		WHITE, GRANULAR (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		3-5% CHRYSOTILE	TAR
L385235	17	BEIGE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 35% MINERAL WOOL PERLITE, OTHER
L385236	18	BEIGE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 35% MINERAL WOOL PERLITE, OTHER
L385237	19	BEIGE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 35% MINERAL WOOL PERLITE, OTHER
L385238	20	WHITE, CHALKY HOMOGENEOUS (CEILING TILE)		NONE DETECTED	5% GLASS FIBERS OTHER
L385239	21	WHITE, CHALKY HOMOGENEOUS (CEILING TILE)		NONE DETECTED	5% GLASS FIBERS OTHER

Laboratory Manager

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Departures from the test method: **None**
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Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385240	22	WHITE, CHALKY HOMOGENEOUS (CEILING TILE)		NONE DETECTED	5% GLASS FIBERS OTHER
L385241	23	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	85% MINERAL WOOL 5% CELLULOSE OTHER
L385242	24	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	85% MINERAL WOOL 5% CELLULOSE OTHER
L385243	25	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	85% MINERAL WOOL 5% CELLULOSE OTHER
L385244	26	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER
L385245	27	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER

Laboratory Manager

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Departures from the test method: **None**
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EPA 600/R-93/116, July 1994
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Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385246	28	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER
L385247	29	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER
L385248	30	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER
L385249	31	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER

Laboratory Manager

*Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.
Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
Analysis results on this test report pertain only to those materials tested.
Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385250	32	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% GLASS FIBERS OTHER
L385251*	33	YELLOW, GUMMY NONHOM (MASTIC)		NONE DETECTED	OTHER
		BEIGE, GRANULAR (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L385252*	34	YELLOW, GUMMY NONHOM (MASTIC)		NONE DETECTED	OTHER
		BEIGE, GRANULAR (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385253*	35	YELLOW, GUMMY NONHOM (MASTIC)		NONE DETECTED	OTHER
		BEIGE, GRANULAR (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L385254	36	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385255	37	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385256	38	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385257	39	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385258	40	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385259	41	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE

Laboratory Manager

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Departures from the test method: **None**
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385260	42	BEIGE, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	40% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385261	43	LT. GRAY, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385262	44	LT. GRAY, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385263	45	LT. GRAY, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385264	46	TAN, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385265	47	TAN, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385266	48	TAN, GUMMY HOMOGENEOUS (DUCT MASTIC)		NONE DETECTED	OTHER
L385267	49	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR

Laboratory Manager

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Departures from the test method: **None**
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TDH Lab 30-0031

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Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385268	50	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR
L385269	51	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR
L385270	52	BLACK, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR
L385271	53	BLACK, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR

Laboratory Manager

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Departures from the test method: **None**
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TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385272	54	BLACK, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	5% CELLULOSE TAR
L385273	55	WHITE, GUMMY HOMOGENEOUS (INT. WINDOW CAULKING)		NONE DETECTED	OTHER
L385274	56	WHITE, GUMMY HOMOGENEOUS (INT. WINDOW CAULKING)		NONE DETECTED	OTHER
L385275	57	WHITE, GUMMY HOMOGENEOUS (INT. WINDOW CAULKING)		NONE DETECTED	OTHER
L385276*	58	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L385277*	59	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY., KINGWOOD, TX

Date Received: 01/25/2024
Date Analyzed: 01/30/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385278*	60	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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L385219-385278 CSP#2026-08

LOFLIN

X3

Environmental Services, Inc.

2020 MONTROSE, Ste. 100 – HOUSTON, TX 77006

Client: Humble I.S.D

Contact:

Client Address:

Phone/Email:

Lab Project # 62-23-27

Project Location: Creekwood Middle School 3603 W. Lake Houston Pkwy. Kingwood, TX 77339

Date: 1-24-24

PLM ANALYSIS TURNAROUND

☐ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☒ 2 Day ☐ 3 Day ☐ 1 Week

POINT COUNT (400 Point <.25%) TURNAROUND

☐ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 1 Week

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
385219	01	Carpet Glue + Black Mastic
385220	02	"
221	03	"
222	04	Baseboard w/ glue
223	05	" "
224	06	" "
225	07	CMU texture
226	08	" "
227	09	" "
228	10	" "
229	11	" "
230	12	" "
231	13	" "
232	14	laminate flooring
233	15	laminate flooring
234	16	" "
235	17	2x2 ceiling tile - old style
236	18	" "
237	19	" "
238	20	2x2 Sheetrock ceiling tile

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
		Music - Perf Practice room 1
		" - Choir Practice 1
		" - Band practice 2
		Band Hall storage
		~~Band Hall~~ Culinary
		Cafe
		Band Hall
		Band Hall
		Band Hall storage
		Choir
		Choir
		Choir storage
		Choir ~~storage~~ Culinary
		Band Hall
		Band Hall
		Band Hall
		Music room
		~~Choir room~~ Culinary room
		Cafe
		Choir room

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY:	RECEIVED BY: Marissa Manchaca
DATE/ TIME: 1-24-24	DATE/ TIME: 1/25/24 10:15am
RELINQUISHED BY:	RECEIVED BY:
DATE/ TIME:	DATE/ TIME:

CSP#2026-08

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:
CHAIN OF CUSTODY (cont.) 2/3	PAGE_____ OF_____
LOFLIN JOB #: 62-23-27	CLIENT:
CLIENT JOB:	CLIENT PO:

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
385239	21	〃	—	Band Hall	
385240	22	〃	—	Choir room	
241	23	1x1 Ceiling tile	—	Chiropractic room 1	
242	24	〃	—	Band Practice room 1	
243	25	〃	—	Choir Practice Room 2	
244	26	wallboard system	—	Choir room	
245	27	〃	—	Choir room	
246	28	〃	—	Choir room	
247	29	〃	—	Band Hall	
248	30	〃	—	c+e	
249	31	〃	—	c+e	
250	32	〃	—	~~c+e~~ Culinary	
251	33	12x12 Green f.t. w/ mastic	—	under laminate flooring	
252	34	〃	—	〃	
253	35	〃	—	〃	
254	36	Spray-on fire proofing	—	Band Hall	
255	37	〃	—	Band Hall	
256	38	〃	—	Choir Hall	
257	39	〃	—	Choir Hall	
258	40	〃	—	Choir Hall	
259	41	〃	—	c+e	
260	42	〃	—	~~c+e~~ culinary	
261	43	Gray duct mastic	—	Shop Elect Closet	
262	44	〃	—	〃	
263	45	〃	—	〃	
264	46	White duct mastic	—	c+e	
265	47	〃	—	c+e	
266	48	〃	—	c+e	
267	49	12x12 white f.t. w/ Blk	—	c+e office area	
268	50	〃	—	c+e office area	
269	51	〃	—	c+e office area	
270	52	12x12 black f.t.	—	c+e	
271/272	53/54		—	c+e	
			—	c+e	

CHAIN OF CUSTODY SIGNATURE	
RELINQUISHED BY:	RECEIVED BY: Marissa Manchaca
DATE/TIME:	DATE/TIME: 1/25/24 10:15am

RELINQUISHED BY: DATE/TIME:			RECEIVED BY: DATE/TIME:		
CHAIN OF CUSTODY (cont.) 3/3			PAGE____ OF____		
LOFLIN JOB #: 62-63-27			CLIENT:		
CLIENT JOB:			CLIENT PO:		
LAB NUMBER	**FIELD NUMBER**	**SAMPLE DESCRIPTION**	**LAB NUMBER**	**FIELD NUMBER**	**SAMPLE DESCRIPTION**
385273	55	Interior window casing	—	Cte	office
385274	56	"	—	Cte	office
275	57	"	—	Cte	office
276	58	12x12 white tile	—	Culinary	pantry
277	59		—	"	storage
278	60		—	"	main

CHAIN OF CUSTODY SIGNATURE	
RELINQUISHED BY: DATE/TIME:	RECEIVED BY: Marissa Manavade DATE/TIME: 1/25/24 10:15am

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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27B
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY, KINGWOOD, TX

Date Received: 02/15/2024
Date Analyzed: 02/15/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L386295*	01	BLACK, TARRY HOMOGENEOUS (VAPOR BARRIER MASTIC)		5-7% CHRYSOTILE	TAR
L386296	02	LT. GRAY, GUMMY HOMOGENEOUS (ROOF CAP CAULKING)		NONE DETECTED	OTHER
L386297	03	BLACK, FIBROUS NONHOM (MAIN ROOF)		NONE DETECTED	35% GLASS FIBERS TAR, AGGREGATE
		BLACK, TARRY (MAIN ROOF)		NONE DETECTED	TAR, AGGREGATE, OTHER
L386298	04	WHITE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386299	05	WHITE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386300	06	WHITE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386301	07	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386302	08	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER

Laboratory Manager

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Departures from the test method: ***None***
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NVLAP 10-2044
TDH Lab 30-0031

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EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27B
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY, KINGWOOD, TX

Date Received: 02/15/2024
Date Analyzed: 02/15/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L386303	09	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386304	10	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386305	11	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386306	12	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386307	13	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% CELLULOSE OTHER
L386308	14	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% CELLULOSE OTHER
L386309	15	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% CELLULOSE OTHER
L386310	16	WHITE, GUMMY HOMOGENEOUS (EXPANSION JOINT CAULK)		NONE DETECTED	OTHER
L386311	17	BEIGE, GUMMY HOMOGENEOUS (DOM. WATER LINE MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER

Laboratory Manager

**Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.*
Departures from the test method: ***None***
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
Analysis results on this test report pertain only to those materials tested.
Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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CSP# 2026-08 **Loflin Environmental Services, Inc.** 2020 Montrose Blvd., Houston, Texas 77006
(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-27B
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY, KINGWOOD, TX

Date Received: 02/15/2024
Date Analyzed: 02/15/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L386312	18	TAN, GUMMY HOMOGENEOUS (DOM. WATER LINE MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L386313	19	WHITE, FIBROUS HOMOGENEOUS (DOM. WATER LINE WRAP)		NONE DETECTED	50% CELLULOSE OTHER

Laboratory Manager

**Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.*
Departures from the test method: ***None***
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CSP# 2026-08

L386295-386313

RUSH

LOFLIN
Environmental Services, Inc.
2020 MONTROSE, Ste. 100 – HOUSTON, TX 77006

Client: Humble ISD

Contact:

Client Address:

Phone/Email:

Lab Project # 6-23-27B

Project Location: Creekwood middle school 3603 W. Lake Houston Pkwy Kingwood TX

Date: 2-14-24

PLM ANALYSIS TURNAROUND
☒ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 1 Week

POINT COUNT (400 Point <.25%) TURNAROUND
☐ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 1 Week

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
386295	01	Vapor barrier mastic	Roof of Bldg		
386296	02	Roof cap caulking	roof		
297	03	Back roof	roof		
298	04	Chill water supply	Culinary	Hall	
299	05	" "	"	"	
300	06	" "	Band	Hallway	
301	07	Chill water return			
302	08	" "			
303	09	" "			
304	10	Hot water supply			
305	11	" "			
306	12	" "			
307	13	Hot water return			
308	14	" "			
309	15	" "			
310	16	Expansion joint caulking	Roof of Bldg		
311	17	Domestic water line	Culinary	Hall	
312	18	" "	"	"	
313	19	" "	"	"	

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY:
DATE/ TIME: 2-15-24

RECEIVED BY: Marissa Manchaca
DATE/ TIME: 2/15/24 10:50am

RELINQUISHED BY:

RECEIVED BY:

CSP# 2026-08 **Loflin Environmental Services, Inc.** 2020 Montrose Blvd., Houston, Texas 77006
(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-05
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY, KINGWOOD, TX

Date Received: 03/14/2024
Date Analyzed: 03/14/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L387956*	01	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387957*	02	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387958*	03	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387959*	04	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387960*	05	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387961*	06	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387962*	07	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387963*	08	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387964*	09	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR

Laboratory Manager

*Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.
Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
Analysis results on this test report pertain only to those materials tested.
Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-05
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY, KINGWOOD, TX

Date Received: 03/14/2024
Date Analyzed: 03/14/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L387965*	10	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L387966	11	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387967	12	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387968	13	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387969	14	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387970	15	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387971	16	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L387972	17	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

**Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.*
Departures from the test method: ***None***
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L387956-387972

CSP# 2026-08

Rush Immediate

Environmental Services, Inc.
2020 MONTROSE, Ste. 100 – HOUSTON, TX 77006

Client: Humble ISD

Contact:

Client Address:

Phone/Email:

Lab Project # 62-24-05

Project Location: Creekwood Middle School 3603 W. Lake Houston Pkwy Kingwood, TX

Date: 3-14-24

PLM ANALYSIS TURNAROUND
- [x] Immediate (< 3 Hours)
- [ ] Same Day
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 1 Week

POINT COUNT (400 Point <.25%) TURNAROUND
- [ ] Immediate (< 3 Hours)
- [ ] Same Day
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 1 Week

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
387956	01	Black floor mastic	- 700B		
387957	02	"	- 701		
958	03	"	- 703		
959	04	"	- 500 TP		
960	05	"	- 301		
961	06	"	- 303		
962	07	"	- 307		
963	08	"	- 202		
964	09	"	- Clinic		
965	10	"	- Conference office		
966	11	Yellow floor mastic	- Library		
967	12	"	- Theater		
968	13	"	- 501		
969	14	"	- 404		
970	15	"	- 601		
971	16	"	- 603		
972	17	"	- FICA office		

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY: [signature] DATE/ TIME: 3-14-24	RECEIVED BY: Marissa Manchaca DATE/ TIME: 3/14/24 8:50AM
RELINQUISHED BY: DATE/ TIME:	RECEIVED BY: DATE/ TIME:

CSP# 2026-08 **Loflin Environmental Services, Inc.** 2020 Montrose Blvd., Houston, Texas 77006
(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389002	01	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389003	02	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389004	03	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389005	04	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389006	05	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389007	06	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389008	07	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389009	08	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389010	09	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

**Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.*
Departures from the test method: ***None***
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389011	10	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389012	11	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389013	12	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389014	13	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389015	14	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389016	15	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389017	16	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389018	17	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389019	18	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: **None**
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NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389020	19	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389021	20	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389022	21	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389023	22	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389024	23	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389025	24	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389026	25	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389027	26	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389028	27	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: **None**
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(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389029	28	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389030	29	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389031	30	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389032	31	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389033	32	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389034	33	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389035	34	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389036	35	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389037	36	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: **None**
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389038	37	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER,
L389039*	38	YELLOW, CRUMBLY NONHOM (FLOOR MASTIC)		NONE DETECTED	OTHER
		BLACK, TARRY (FLOOR MASTIC)		1-2% CHRYSOTILE	TAR
L389040*	39	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389041*	40	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389042*	41	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389043*	42	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389044*	43	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389045*	44	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389046*	45	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389047*	46	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

*Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.
Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
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Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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CSP# 2026-08 **Loflin Environmental Services, Inc.** 2020 Montrose Blvd., Houston, Texas 77006
(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389048*	47	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389049*	48	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		1-2% CHRYSOTILE	TAR
L389050*	49	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		1-2% CHRYSOTILE	TAR
L389051*	50	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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NVLAP 10-2044
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Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389052*	51	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389053*	52	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389054*	53	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389055*	54	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		3-5% CHRYSOTILE	TAR

Laboratory Manager

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Departures from the test method: **None**
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NVLAP 10-2044
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Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389056*	55	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389057*	56	WHITE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		LT. GRAY, CRUMBLY (OTHER)		NONE DETECTED	CALCITE, OTHER
		BLACK, TARRY (MASTIC)		2-3% CHRYSOTILE	TAR
L389058*	57	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389059*	58	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389060	59	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		YELLOW, GUMMY (MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: **None**
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EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389061	60	BROWN, RUBBERY NONHOM (FLOOR TILE)		NONE DETECTED	OTHER
		BLUE, GUMMY (MASTIC)		NONE DETECTED	OTHER
		LT. GRAY, CRUMBLY (OTHER)		NONE DETECTED	1% CELLULOSE CALCITE, OTHER
L389062	61	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389063	62	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389064	63	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389065*	64	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		3-5% CHRYSOTILE	TAR
L389066*	65	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		4-6% CHRYSOTILE	TAR
L389067*	66	BLACK, TARRY HOMOGENEOUS (FLOOR MASTIC)		4-6% CHRYSOTILE	TAR

Laboratory Manager

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Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-24-08
Project Name: CREEKWOOD MIDDLE SCHOOL, 3603 W. LAKE HOUSTON PKWY

Date Received: 03/28/2024
Date Analyzed: 03/28/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L389068	67	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389069	68	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389070	69	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER
L389071*	70	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		4-6% CHRYSOTILE	TAR
L389072*	71	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		4-6% CHRYSOTILE	TAR
L389073	72	YELLOW, CRUMBLY HOMOGENEOUS (FLOOR MASTIC)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: **None**
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L389002 - 389073

CSP# 2026-08

LOFLIN

Environmental Services, Inc.

2020 MONTROSE, Ste. 100 – HOUSTON, TX 77006

VB RUSH

Client: Humble ISD

Contact:

Client Address:

Phone/Email:

Lab Project # 62-24-08

Project Location: Creekwood middle School 3603 W. Lake Houston Pkwy

Date: 3-28-24

PLM ANALYSIS TURNAROUND

- [x] Immediate (< 3 Hours)
- [ ] Same Day
- [ ] 1 Day
- [x] ~~2 Day~~
- [ ] 3 Day
- [ ] 1 Week

POINT COUNT (400 Point <.25%) TURNAROUND

- [ ] Immediate (< 3 Hours)
- [ ] Same Day
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 1 Week

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
389002	01	yellow floor mastic	- 705		
389003	02		- 707		
004	03		- 709		
005	04		- 502		
006	05		- 504		
007	06		- 506		
008	07		- 508		
009	08		- ~~501~~ 505		
010	09		- 503		
011	10		- 507		
012	11		- 302		
013	12		- 304		
014	13		- 306		
015	14		- 308		
016	15		- 310		
017	16		- 100		
018	17		- 208		
019	18		- 201		
020	19		- 203		
021	20		- 205		

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY:	RECEIVED BY: Marissa Manchade
DATE/ TIME: 3-28-24	DATE/ TIME: 3/28/24 9AM
RELINQUISHED BY:	RECEIVED BY:
DATE/ TIME:	DATE/ TIME:

CSP# 2026-08

RELINQUISHED BY: DATE/TIME: 3/28	RECEIVED BY: DATE/TIME:
CHAIN OF CUSTODY (cont.)	PAGE____ OF____
LOFLIN JOB #:	CLIENT: Humble ISD
CLIENT JOB:	CLIENT PO:

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
389022	21	Yellow floor mask	- 207		
023	22	"	- 407		
024	23	"	- 404		
025	24	"	- 406		
026	25	"	- 408		
027	26	"	- 410		
028	27	"	- 401		
029	28	"	- 405		
030	29	"	- 405		
031	30	"	- 407		
032	31	"	- 607		
033	32	"	- 609		
034	33		- 606		
035	34	"	- 608		
036	35	"	- 610		
037	36	"	- 605		
038	37		- 607		
039	38	Black floor mask	- Orchestra		
040	39	"	- 906		
041	40	"	- 505		
042	41		- 305		
043	42		- 102		
044	43		- 104		
045	44		- 106		
046	45		- 108		
047	46		- 101		
048	47		- 206		
049	48		- 200 wks Teeth		
050	49		- 400 wks Teeth		
051	50		- box wks arm		
052	51		- Cafeteria		
053	52		- Hilem Office		
↓ 054	~~53~~		- copy room		

CHAIN OF CUSTODY SIGNATURE	
RELINQUISHED BY: DATE/TIME: 3-28-24	RECEIVED BY: Marissa Manchaca DATE/TIME: 3/28/24 9AM

CSP# 2026-08

RELINQUISHED BY: 3/3 DATE/TIME:	RECEIVED BY: DATE/TIME:
CHAIN OF CUSTODY (cont.)	PAGE_____ OF_____
LOFLIN JOB #:	CLIENT: Humble ISD
CLIENT JOB:	CLIENT PO:

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
389055	54	Black floor mesh	- Office	R/R	
389056	55		- office	Black room	
057	56		- Clinic		
058	57		- 204		
059	58		- Medical Production - library		
060	59	Yellow mesh + tile	- Front office South side		
061	60	"	" - Front office North side		
062	61	"	" - Principal office area		
063	62	"	" - Stage	Stelage	
064	63	"	" - Stage		
065	64	Black floor mesh	- Seminar work room		
066	65		- Principals		
067	66	"	- ~~History office~~		
068	67	Yellow mesh	- MTS Office		
069	68		- Conference		
070	69		- Principal Asst. Office		
071	70	Black mesh + tile	- 3D Printer room		
072	71	"	" - Data room		
✓073	72	Yellow mesh	- Middle office		

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY: DATE/TIME: 3-28-24	RECEIVED BY: Marissa Manohade DATE/TIME: 3/28/24 9AM

CSP# 2026-08

LOFLIN ENVIRONMENTAL SERVICES, INC.

February 13, 2024

Ms. Leigh Ann Johnson
Humble ISD Support Services Division
P.O. Box 2000
Humble, Texas 77347

AHERA ASBESTOS INSPECTION(ADDITIONS/RENOVATIONS)
RIVERWOOD MIDDLE SCHOOL
2910 HIGH VALLEY DR.
HUMBLE, TEXAS

INTRODUCTION

Loflin Environmental Services, Inc. performed an EPA required AHERA inspection of the Riverwood Middle School building, located at 2910 High Valley Dr. in Humble, Texas on January 30, 2024. The inspection was performed by Mr. Michael Hendrix & Mathew Songster, an EPA accredited and Texas DSHS licensed asbestos inspector in general accordance with the requirements of 40 CFR Part 763, Subpart E, Section 763.85(b).

The purpose of the inspection was to:

- Identify all friable and non-friable asbestos containing materials.
- Observe and touch all suspect materials, identifying those materials, and either sampling or assuming suspect materials to contain asbestos.
- Sample locations will be documented on a legible drawing of school building.
- Any materials resulting as asbestos containing will be documented on a drawing and quantified.
- A condition assessment will be provided for all asbestos containing materials.

LIMITATIONS

Inaccessible areas, such as wall cavities, pipe chases, flooring under carpeting, and above sheetrock or plaster ceilings and outside the building do not fall within the scope of an AHERA asbestos inspection.

FACILITY DESCRIPTION

The Riverwood Middle School consists of an approximately 138,000 square foot one-story building, which was constructed in 1991. The building construction consists of a steel beam frame with brick veneer over a concrete foundation. The interior walls are

sheetrock. The floors are covered with ceramic floor tile, vinyl floor tile, floor coating or carpet. The ceilings consist of sheetrock and lay-in ceiling tile. Heating and air conditioning are supplied by HVAC units and distributed through fabricated sheet metal ducts with fiberglass insulation.

HOMOGENOUS MATERIALS

- Carpet glue
- 12” x 12” Gray Floor Tile
- Cove base mastic
- Wallboard system
- 2’ x 2’ Ceiling tile
- 1’ x1’ Ceiling tile
- Spray-on fire proofing
- Chill water supply and return
- Hot water supply and return
- Domestic water line
- HVAC insulation
- Gray duct mastic
- Vapor barrier mastic
- Expansion joint caulking
- Vent caulking
- Exterior door caulking
- Plaster texture on eve
- Roof cap caulking

SUMMARY OF FINDINGS

Based on laboratory analysis, none of the sampled materials were found to contain asbestos.
*****NO CORE ROOF SAMPLES TAKEN DUE TO TPO ROOF COVER*****

RECOMMENDATIONS

Humble I.S.D. must maintain a copy of this report with the Asbestos Operations and Maintenance (O & M) file and at the location of Riverwood Middle School. Any suspect materials discovered during renovation or demolition activities that were not addressed in this report should be promptly tested for asbestos content by a Texas DSHS licensed asbestos inspector.

A listing of homogeneous materials that were sampled and bulk sample locations with a drawing of the school building is included in this report.

Should you have any questions regarding this report, please contact us at (713) 521-3300

Kind Regards,



Michael Hendrix
Texas DSHS Inspector #602838

HOMOGENEOUS MATERIALS/BULK SAMPLE LOCATIONS

- **Carpet glue**
  - 01 – Music 103
  - 02 – Music 903
  - 03 - Music 904
- **12” x 12” Gray floor tile**
  - 04 – Music 103
  - 05 – Music 903
  - 06 – Music 903
- **Cove base mastic**
  - 07 – Music 903
  - 08 – Music 903
  - 09 – Music 904
- **Wallboard system**
  - 10 – IT 902
  - 11 – IT 902
  - 12 – IT 902
  - 13 – Room 103
  - 14 – Room 103
  - 15 – Room 103
  - 16 – Room 103
- **2’ x 2’ Ceiling tile**
  - 17 – Music 103
  - 18 – Music 904
  - 19 – Hall near 904
- **1’ x 1’ Ceiling tile**
  - 20 – Music 903
  - 21 – Music 904
  - 22 – Music 904
- **Spray-on fire proofing**
  - 23 – Music 903
  - 24 – Music 903
  - 25 – Music 904
  - 26 – Music 904

27– 100 Hallway
28 – Room 103
29 – Room 103

- **Chill water supply**

30 – Band hall
31 – Band hall
32 – 100 Hallway

- **Chill water return**

33 – Band hall
34 – Band hall
35 – 100 Hallway

- **Hot water supply**

36 – Band hall
37 – 100 Hallway
38 – Room 103

- **Hot water return**

39 – Band hall
40 – 100 Hallway
41 – Room 103

- **Domestic water line**

42 – Band hall
43 – 100 Hallway
44 – 100 Hallway

- **HVAC insulation**

45 – Band hall
46 – 100 Hallway
47 – IT 902

- **Gray duct mastic**

48 – Room 103
49 – Room 103
50 – Room 103

- **Vapor barrier mastic**

51 – Rear of building

- **Expansion joint caulking**

52 – rear of building

- **Vent caulking**

53 – Rear of building

- **Door caulking**

54 – Rear of building

- **Plaster eve**

55 – Rear exit

- **Roof cap caulking**

56 – east side roof

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Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385566	01	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		NONE DETECTED	10% CELLULOSE TAR
L385567	02	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		NONE DETECTED	10% CELLULOSE TAR
L385568	03	BLACK, TARRY HOMOGENEOUS (CARPET MASTIC)		NONE DETECTED	10% CELLULOSE TAR
L385569	04	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	10% CELLULOSE TAR
L385570	05	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	10% CELLULOSE TAR
L385571	06	BEIGE, GRANULAR NONHOM (FLOOR TILE)		NONE DETECTED	CALCITE, VINYL, QUARTZ
		BLACK, TARRY (MASTIC)		NONE DETECTED	10% CELLULOSE TAR

Laboratory Manager

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Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385572	07	BEIGE, GUMMY HOMOGENEOUS (COVE BASE MASTIC)		NONE DETECTED	OTHER
L385573	08	BEIGE, GUMMY HOMOGENEOUS (COVE BASE MASTIC)		NONE DETECTED	OTHER
L385574	09	BEIGE, GUMMY HOMOGENEOUS (COVE BASE MASTIC)		NONE DETECTED	OTHER
L385575	10	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385576	11	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385577	12	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER

Laboratory Manager

*Asbestos-containing materials - The type and percentage of various fibrous components was determined by the microscopist in accordance with the U.S. Environmental Protection Agency's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", as found in 40 CFR, Part 763, Subpart E, Appendix E and the "Method For The Determination Of Asbestos In Bulk Samples" EPA 600/R-93/116, July 1993.
Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
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(713) 521-3300 Fax (713)523-0829

LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

Report of Bulk Sample Analysis For Asbestos Identification

Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385578	13	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385579	14	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385580	15	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385581	16	WHITE, POWDERY NONHOM (JOINT COMPOUND)		NONE DETECTED	CALCITE, QUARTZ, MICA, OTHER
		WHITE, CHALKY (SHEETROCK)		NONE DETECTED	5% CELLULOSE OTHER
L385582	17	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 30% MINERAL WOOL PERLITE, OTHER

Laboratory Manager

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Departures from the test method: **None**
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EPA 600/R-93/116, July 1994
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Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385583	18	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 30% MINERAL WOOL PERLITE, OTHER
L385584	19	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	40% CELLULOSE 30% MINERAL WOOL PERLITE, OTHER
L385585	20	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	80% MINERAL WOOL 10% CELLULOSE OTHER
L385586	21	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	80% MINERAL WOOL 10% CELLULOSE OTHER
L385587	22	WHITE, FIBROUS HOMOGENEOUS (CEILING TILE)		NONE DETECTED	80% MINERAL WOOL 10% CELLULOSE OTHER
L385588	23	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385589	24	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385590	25	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385591	26	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE

Laboratory Manager

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Departures from the test method: **None**
The above test report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
Analysis results on this test report pertain only to those materials tested.
Disclaimers: Asbestos content is quantified using Calibrated Visual Estimate. PLM analysis has been known to be inaccurate for materials with low concentrations of asbestos. Negative PLM results cannot be guaranteed. LES recommends using TEM analysis for materials reported as <1% or none detected.
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NVLAP 10-2044
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Polarized Light Microscopy (PLM)
EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385592	27	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385593	28	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385594	29	TAN, FIBROUS HOMOGENEOUS (FIREPROOFING)		NONE DETECTED	30% CELLULOSE 15% GLASS FIBERS CALCITE, VERMICULITE
L385595	30	BEIGE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385596	31	BEIGE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385597	32	BEIGE, GUMMY HOMOGENEOUS (CWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385598	33	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385599	34	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385600	35	WHITE, GUMMY HOMOGENEOUS (CWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER

Laboratory Manager

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Departures from the test method: **None**
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EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385601	36	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385602	37	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385603	38	WHITE, GUMMY HOMOGENEOUS (HWS MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385604	39	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385605	40	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385606	41	WHITE, GUMMY HOMOGENEOUS (HWR MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385607	42	WHITE, GUMMY HOMOGENEOUS (DOM. WATER LINE MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385608	43	WHITE, GUMMY HOMOGENEOUS (DOM. WATER LINE MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385609	44	WHITE, GUMMY HOMOGENEOUS (DOM. WATER LINE MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER

Laboratory Manager

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EPA 600/R-93/116, July 1994
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Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385610	45	WHITE, GUMMY HOMOGENEOUS (HVAC INSUL. MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385611	46	WHITE, GUMMY HOMOGENEOUS (HVAC INSUL. MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385612	47	WHITE, GUMMY HOMOGENEOUS (HVAC INSUL. MASTIC)		NONE DETECTED	3% WOLLASTONITE OTHER
L385613	48	DK. GRAY, GUMMY HOMOGENEOUS (HVAC DUCT MASTIC)		NONE DETECTED	3% CELLULOSE CALCITE, OTHER
L385614	49	DK. GRAY, GUMMY HOMOGENEOUS (HVAC DUCT MASTIC)		NONE DETECTED	3% CELLULOSE CALCITE, OTHER
L385615	50	DK. GRAY, GUMMY HOMOGENEOUS (HVAC DUCT MASTIC)		NONE DETECTED	3% CELLULOSE CALCITE, OTHER
L385616	51	BLACK, TARRY HOMOGENEOUS (VAPOR BARRIER MASTIC)		NONE DETECTED	TAR, OTHER
L385617	52	WHITE, RUBBERY HOMOGENEOUS (EXPANSION JOINT CAULKING)		NONE DETECTED	OTHER
L385618	53	WHITE, RUBBERY HOMOGENEOUS (VENT CAULKING)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: ***None***
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LOFLIN

NVLAP 10-2044
TDH Lab 30-0031

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EPA 600/R-93/116, July 1994
40 CFR, Part 763, Subpart E, Appendix E

Client: HUMBLE ISD
Client Address: PO BOX 2000, HUMBLE, TX 77347
Project No: 62-23-28
Project Name: RIVERWOOD MIDDLE SCHOOL, 2910 HIGH VALLEY DR., HUMBLE, TX

Date Received: 01/31/2024
Date Analyzed: 02/12/2024

Lab Number	Field Number	Sample Description (Components)	Sample Location	Asbestos Detected	Additional Constituents
L385619	54	BLACK, RUBBERY HOMOGENEOUS (DOOR CAULKING)		NONE DETECTED	OTHER
L385620	55	WHITE, GRANULAR HOMOGENEOUS (PLASTER TEXTURE)		NONE DETECTED	AGGREGATE, OTHER
L385621	56	RED, GUMMY HOMOGENEOUS (ROOF CAP CAULKING)		NONE DETECTED	OTHER

Laboratory Manager

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Departures from the test method: ***None***
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L385566-385621

CSP# 2026-08

K3

Environmental Services, Inc.

2020 MONTROSE, Ste. 100 – HOUSTON, TX 77006

Client: Humble ISD

Contact:

Client Address:

Phone/Email:

Lab Project # 62-23-28

Project Location: Riverwood Middle School

2910 High Valley Dr., Humble, TX

Date: 1-30-24

PLM ANALYSIS TURNAROUND

☐ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☒ 2 Day ☐ 3 Day ☐ 1 Week

POINT COUNT (400 Point <.25%) TURNAROUND

☐ Immediate (< 3 Hours) ☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 1 Week

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
385566	01	Carpet Sive
385567	02	"
568	03	"
569	04	12x12 Grey floor tile
570	05	"
571	06	"
572	07	Cove base Mastic
573	08	"
574	09	"
575	10	~~Cmu texture~~ wallboard system
576	11	
577	12	
578	13	
579	14	
580	15	
581	16	"
582	17	2x2 ceiling tile
583	18	"
584	19	"
585	20	1x1 ceiling tile

LAB NUMBER	FIELD NUMBER
—	~~Mastic~~ 103
—	Music 903
—	Music 904
—	~~Mastic~~ 103
—	Music 903
—	Music 903
—	Music 903
—	Music 903
—	Music 904
—	IT 902
—	IT 902
—	IT 902
—	Room 103
—	" "
—	" "
—	" "
—	~~Mastic~~ 103
—	Music 904
—	Hall Next 904
—	Music 903

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY:

DATE/ TIME: 1-30-24

RELINQUISHED BY:

DATE/ TIME:

RECEIVED BY: Marissa Manchaca

DATE/ TIME: 1/31/24 1:20 PM

RECEIVED BY:

DATE/ TIME:

CSP# 2026-08

RELINQUISHED BY: DATE/TIME: 8/3	RECEIVED BY: DATE/TIME:
CHAIN OF CUSTODY (cont.)	PAGE_____ OF_____
LOFLIN JOB #:	CLIENT:
CLIENT JOB:	CLIENT PO:

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
385586	21	1"
385587	22	"
588	23	Sprayed Fire Proofing
589	24	"
590	25	"
591	26	"
592	27	"
593	28	"
594	29	"
595	30	Chill water supply — Bam Hall
596	31	" — " "
597	32	" — 100 Hall
598	33	Chill water return — Bam Hall
599	34	" — " "
600	35	" — 100 Hall
601	36	Hot water supply — Bam Hall
602	37	" — 100 Hall
603	38	" — Room 105
604	39	Hot water return — Bam Hall
605	40	" — 100 Hall
606	41	" — Room 103
607	42	Domestic water line — Bam Hall
608	43	" — 100 Hall
609	44	" — " "
610	45	HVAC insulation - Unit — ~~Hall~~ Bam Hall
611	46	" — ~~Hall~~ 100 Hall
612	47	" — IT 902
613	48	Gray HVAC Duct Mastic — Room 103
614	49	" " "
615	50	" " "
616	51	Vapor barrier mastic
617	52	Expansion joint (caulking)
618	53	Vent caulking

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
MUSIC	904	
MUSIC	904	
MUSIC	903	
MUSIC	903	
MUSIC	704	
MUSIC	704	
100 Hallway		
Room	103	
"	"	

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY: DATE/TIME:	RECEIVED BY: Marissa Manchade DATE/TIME: 1/31/24 1:20pm

CSP# 2026-08

RELINQUISHED BY: DATE/TIME:	RECEIVED BY: DATE/TIME:
CHAIN OF CUSTODY (cont.) 3/3	PAGE_____ OF_____
LOFLIN JOB #:	CLIENT:
CLIENT JOB:	CLIENT PO:

LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION	LAB NUMBER	FIELD NUMBER	SAMPLE DESCRIPTION
385619	54	Door Caulking			
385620	55	Plaster tkt EVE			
385621	56	foot cap Caulking			

CHAIN OF CUSTODY SIGNATURE

RELINQUISHED BY: DATE/TIME:	RECEIVED BY: Marissa Manchado DATE/TIME: 1/31/24 1:20PM

CSP# 2026-08



LOFLIN Environmental Services, Inc. 2020 Montrose Blvd., Suite 100 Houston, Tx 77006 (713)351-1301/(713)494-4442	**Approximate Sample Location Diagram** ***Client: Humble ISD**	**Riverwood Middle School** **2910 High Valley Dr.** **Humble, Texas** **Job # 62-23-28**

SECTION 00 3132
GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.

1.02 INVESTIGATION

A. Creekwood Middle School:
   1. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and these investigations were made by Terracon Consultants, Inc., report number 92235201, dated July 20, 2023.

B. Riverwood Middle School:
   1. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and these investigations were made by Terracon Consultants, Inc., report number 92235207, dated July 20, 2023.

1.03 REPORT

A. The complete report of the testing laboratory follows this section and is provided for information only.

B. Report and log of borings are available for Contractor's information but is not a warranty of subsurface conditions, nor is it a part of the Contract Documents.

1.04 RESPONSIBILITY

A. Bidders are expected to examine the site and subsurface investigation reports and then decide for themselves the character of the materials to be encountered.

B. The Owner and Architect assume no responsibility for variations of subsoil quality or conditions.

C. The Owner and the Architect assume no responsibility for any conclusions or interpretations made on the basis of subsurface information contained in the contract documents.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

CSP# 2026-08

Geotechnical Engineering Report

Humble ISD Creekwood Middle School Additions
Kingwood, Texas
July 20, 2023
Terracon Project No. 92235201

Prepared for:
Humble Independent School District
Humble, Texas

Prepared by:
Terracon Consultants, Inc.
Houston, Texas

CSP# 2026-08

July 20, 2023

Humble Independent School District
1703 Wilson Road
Humble, Texas 77396

Attn: Mr. Thomas Haggerty
Executive Director of Construction

Re: Geotechnical Engineering Report
Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway
Kingwood, Texas
Terracon Project No. 92235201

Dear Mr. Haggerty:

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the project referenced above in Kingwood, 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)

Jonathan N. Han, E.I.T.
Staff Geotechnical Engineer

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

STATE OF TEXAS
KARLA I. STRINGER
133252
LICENSED
PROFESSIONAL ENGINEER

Karla I. Stringer, P.E.
Group Manager

REPORT TOPICS

INTRODUCTION 1
SITE CONDITIONS 2
PROJECT DESCRIPTION 2
GEOTECHNICAL CHARACTERIZATION 3
GEOTECHNICAL OVERVIEW 4
EARTHWORK 6
FOUNDATION SYSTEM 9
FLOOR SLABS 12
DETENTION POND 13
PAVEMENTS 14
GENERAL COMMENTS 19
FIGURES 21

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLAN
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
SUPPORTING INFORMATION (General Notes and Unified Soil Classification System)

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Humble ISD Creekwood Middle School Additions

3603 West Lake Houston Parkway

Kingwood, Texas

Terracon Project No. 92235201

July 20, 2023

INTRODUCTION

This report represents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements planned within the existing Creekwood Middle School campus located at 3603 West Lake Houston Parkway in Kingwood, Texas. This project was authorized by Mr. William A. Beattie, Chief Financial Officer of Humble Independent School District (Humble ISD) under the existing Amendment to Contracted Services Agreement, dated April 18, 2023, between Humble ISD and Terracon and through issuance of Purchase Order No. 90440554 on June 6, 2023. This project was performed in general accordance with Terracon Document No. 92235201.Revision1, dated May 8, 2023.

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

- Site and subgrade preparation
- Foundation design and construction
- Detention pond construction considerations
- Pavement design guidelines

The geotechnical engineering Scope of Services for this project included the advancement of nine test borings to depth that ranged from approximately 5 to 20 feet below existing grade.

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

SITE CONDITIONS

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

Item	Description
Project location	The project is within the existing Creekwood Middle School campus located at 3603 West Lake Houston Parkway in Kingwood, Texas. See **Site Location**
Existing improvements	The site is occupied by a two-story school building, two single-story buildings, associated parking and driveway areas, sidewalks, an athletic track and sports field, and overhead power lines.
Current ground cover	Grass, weeds, scattered trees, and rigid and flexible pavements
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	■ A one-story gymnasium and dance support building addition on the west side of the existing school building with a footprint area of approximately 15,200 square feet (sf). ■ A one-story band hall building addition on the southeast side of the existing school building with a footprint area of approximately 4,500 sf. ■ Additional parking areas. ■ A detention pond, about 0.2 to 0.3 acres in size, is planned to be constructed with a maximum depth of 6 feet and maximum side slope declination of 3(Horizontal):1(Vertical) or flatter. We understand the pond will be owned and maintained by Humble ISD.
Building construction[1]	Either steel-frame or concrete masonry unit (CMU) construction with a grade-supported floor slab.
Finished floor elevation	Finished floor elevation is 70.8 feet, which is approximately 1 to 3 feet above existing grade.

Item	Description
Assumed maximum loads	**Grade supported floor slab:** ▪ **Column loads:** 75 to 100 kips ▪ **Floor slab pressure:** 125 pounds per square foot (psf)
Planned foundation system [1]	Drilled-and-underreamed footings
Pavements	We understand a rigid (concrete) and flexible pavement section is being considered. We anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks, and large mutli-axle delivery trucks and buses from time-to-time in driveway areas.

1. Based on information provided by Huckabee

GEOTECHNICAL CHARACTERIZATION

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site for the proposed construction is located on the Beaumont formation, a deltaic nonmarine Pleistocene deposit. The Beaumont formation is heterogeneous containing thick interbedded layers of clay, fine sand, and silt.

The clay fraction is primarily composed of montmorillonite, illite, kaolinite, and finely ground quartz. The clay present in the formation has been preconsolidated by a process of desiccation. Numerous wetting and drying cycles have produced a network of small randomly oriented, closely-spaced joints within some depth zones. These small joints frequently have a shiny appearance and the clays are called slickensided in these cases. The joint pattern may have an influence on the construction and engineering behavior of the soil.

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.

Subsurface Profile

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 site preparation and foundation options. Conditions observed at

each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section 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	**Fill: Sandy Fat Clay and Sandy Lean Clay**	light gray to gray and reddish brown, stiff to very stiff, with ferrous stains
2	**Sandy Lean Clay and Silty Clay**	gray and reddish brown, stiff to very stiff, with ferrous strains
3	**Fat Clay and Sandy Fat Clay**	light gray to gray and reddish brown, stiff, with sand pockets and ferrous stains
4	**Silty Sand and Clayey Sand**	light gray and reddish brown, medium dense to dense, with clay pockets

Groundwater Conditions

Borings B-1 through B-9 were advanced using dry drilling techniques to their termination depths (approximately 5 to 20 feet) in an effort to evaluate groundwater conditions at the time of the field program. Groundwater was observed at boring B-1 at a depth of approximately 18 feet upon completion of drilling. Subsequently boring B-1 caved in at a depth of approximately 18 feet. Groundwater was not observed at borings B-2 through B-9 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.

- Fill soils were observed at the ground surface at borings B-1, B-2 and B-6 and extended to depths that ranged from about 1 to 3 feet. Fill soils may be present at varying depths and at other locations not explored during our field program. Support of the foundation elements, slabs, flatworks, and pavements on or above fill soils is discussed in this report. However, even with the recommended construction testing services, an inherent risk

exists for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill.

- The surficial soils observed in portions of the site exhibited 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 addition 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 addition 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 drilled-and-underreamed footings may be utilized to support the proposed building additions planned at this site.

- A minimum 54-inch thick select fill building pad should be placed under the proposed building additions 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 conditions observed at boring B-8 and B-9, which were drilled in the proposed detention pond area, these soils should support sideslopes for the anticipated maximum excavation depth of 6 feet with sideslope declinations of 3(horizontal):1(vertical) or flatter.

- 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.

- Rigid pavement sections vary from 5.0 to 7.0 inches of reinforced concrete 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 slabs, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, trees, existing, 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 subgrade should be carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck to detect week zones in the subgrade. Special care should be exercised when proofrolling areas containing fill soils in an attempt to observe soft/weak zones within the fill soils. Weak areas detected during proofrolling, as well as zones of fill 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. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction areas 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 D 698) 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 building pad under the grade supported floor slabs and for all grade adjustments within the building additions areas.
On-site soils[1]	Varies	The on-site soils, including the undocumented fill soils, appear suitable for use as fill within the pavement areas, provided they are free of organics and debris.

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 structure should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building additions. We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the building additions 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 additions during and after construction. Water permitted to pond next to the building additions can result in distress in the building additions. 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 additions for at least 10 feet beyond the perimeter of the building additions. After building construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the building additions should also be periodically inspected and adjusted as necessary, as part of the building additions’ maintenance program.

Planters located within 10 feet of the proposed building additions 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 additions. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the proposed building additions or extend down spouts a minimum of 10 feet away from building additions.

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 additions, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft Subgrade Considerations

Due to the elevated silt and sand content and low plasticity of the surficial soils observed at portions of 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 SYSTEM

Based on the subsurface conditions observed during our field and laboratory programs, a foundation system consisting of drilled-and-underreamed footings may be utilized to support the proposed building additions planned at this site, provided the subgrade is properly prepared as described in this report. Recommendations for this type of foundation system are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Drilled-and-Underreamed Footings

Description	Design Parameters
Minimum embedment depth [1]	10 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
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 footing should extend through the fill soils and bear within the native undisturbed clay soils.

Description	Design Parameters
2. Whichever condition yields a larger bearing area. 3. 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 casing local soil failure to the overlying soils. 4. 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. 5. 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. 6. 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 (new and existing) 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. 7. 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. 8. 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 fill and 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. 9. 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 10 feet below final grade will be necessary for installation of drilled-and-underreamed footings for the proposed building additions 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 and sand pockets, 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, silty sand soils were observed at a depth of about 13 feet below existing grade at borings B-1 and B-3. 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.

Foundation Construction Monitoring

The performance of the foundation system for the proposed building additions will be highly dependent upon the quality of construction. Thus, we recommend that subgrade preparation, 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 footing 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.

Connection of Building Addition to Existing Building

Based on the information provided to us, we understand that the new building additions are planned to be built immediately adjacent and connected to the existing school building. Due to the independence of the existing and proposed foundations systems, differential movements may occur between the foundation systems. The magnitude of the differential movement will be primarily dependent upon the stability of the moisture content of the near-surface soils, the quality of foundation construction and subgrade preparation utilized for the building additions, and the performance of the foundation system of the existing structure. Therefore, any members or connections of the new building additions which are common to the adjacent existing structure should be designed such that they are tolerant to differential movements whenever possible.

FLOOR SLABS

Based on information provided to us by Kimley-Horn, we understand the finished floor elevation for the proposed building additions are planned to be 70.8 feet which is approximately 1 to 3 feet above existing grade. If the 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 additions 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 additions. 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 3½ inches.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade supported floor slabs. 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 54 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the building addition areas. This overbuild requirement may be omitted where the building additions are located immediately adjacent to the existing building. The final exterior grade adjacent to the structures should be sloped to promote effective drainage away from the building additions.

Select fill should be utilized for all grade adjustments within the proposed building additions area. The subgrade and select fill soils 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 additions 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 additions. If these adjacent flatwork areas are not prepared as stated above for the grade supported floor slab areas, 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 structure) around the perimeter of the building additions.

DETENTION POND

Based on the information provided to us, we understand that a detention pond is planned to be constructed in the northwest side of the existing middle school building. We understand the proposed detention pond is planned to have a maximum depth of 6 feet with sideslopes no steeper than 3H:1V. The following paragraphs present our recommendations regarding excavation of the detention pond, sideslopes, erosion concerns, and potential use of excavated soils as fill.

Excavation and Slopes

Based on the soil conditions observed at borings B-8 and B-9, which were drilled in the proposed detention pond area, the subgrade soils generally consisted of very stiff to hard sandy lean clay soils. These soils should support sideslopes for the anticipated maximum excavation depth of 6 feet with sideslope declinations of 3H:1V or flatter. If the initial proposed depth of 6 feet is planned to be exceeded or if the sideslopes are planned to be steeper than 3(horizontal):1(vertical), Terracon should be notified for additional services.

Groundwater was not observed at borings B-8 and B-9 during or upon completion of drilling. Therefore, groundwater is not expected to be a major concern during construction. However, depending on climatic conditions, groundwater levels may vary from the levels observed during our field program and minor seepage from the inclusions in the near-surface clay soils could be

observed within the pond's excavation depth, but we anticipate that the minor seepage can be handled with sumps and pumps positioned in the bottom of the excavations.

The suggested method given above serves as a guideline for groundwater control; other appropriate means may be required for groundwater control during the 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.

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 pond, piezometers may be installed, or trenches or pits may be excavated to the planned excavation depth. Based on those results, the contractor should determine effective methods of groundwater management prior to starting excavation operations.

Erosion

If water flow is permitted along the sideslopes of the pond, the surficial soils will likely erode, causing gradual steepening and subsequent sloughing of the sideslopes. Therefore, the sideslopes should be protected against sheet flow down the banks or concentrated high velocity water flow. Measures to protect the sideslopes may include slope paving, rip-rap, geofabrics, or even vegetation with an aggressive root system. Routine maintenance of the sideslopes should be performed to reconstruct areas where sloughing and/or erosion have occurred.

Potential Use of Excavated Soils

The subsurface soils observed at borings B-8 and B-9 (within the area of the proposed detention pond) generally consisted of low to medium plasticity clay soils (with plasticity indices that ranged from 10 to 23 percent) to the anticipated excavation depth (6 feet) of the proposed detention pond.

Excavated soils that meet the select fill criteria (CL or SC with $10 \leq PI \leq 20$) stated within this report, may be used for grade adjustments within the building addition areas. We recommend that additional testing of the on-site soils within the planned borrow areas be performed to confirm that they consistently meet the select fill criteria. Soils that do not meet the select fill criteria should not be utilized in the building addition areas for grade adjustments. However, soils that do not meet select fill criteria may be considered as general fill material in the pavement areas provided they are free of organics and debris.

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 and 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)

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

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 1-2. 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 on-site sand 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 fill soils (PI>15) should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. Based on the classification test results, we recommend that about 5 to 7 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 25 to 35 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 this 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

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

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	**Fill: Sandy Fat Clay and Sandy Lean Clay**	light gray to gray and reddish brown, stiff to very stiff, with ferrous stains
2	**Sandy Lean Clay and Silty Clay**	gray and reddish brown, stiff to very stiff,with ferrous strains
3	**Fat Clay and Sandy Fat Clay**	light gray to gray and reddish brown, stiff, with sand pockets and ferrous stains
4	**Silty Sand and Clayey Sand**	light gray and reddish brown, medium dense to dense, with clay pockets

LEGEND

Fill
Fat Clay
Sandy Fat Clay
Sandy Lean Clay
Silty Clay
Lean Clay
Silty Sand
Clayey Sand

▽ First Water Observation

The groundwater 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.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Approximate Boring Depth [1] (feet)	Boring Location
3 (B-1 through B-3)	20	Proposed gymnasium and dance support building addition areas
2 (B-4 through B-5)	20	Proposed band hall building addition area
2 (B-6 through B-7)	5	Proposed parking addition areas
2 (B-8 through B-9)	10	Proposed detention pond area

1. Below grade at the time of our field program.

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 a standard truck-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 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.

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

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.

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 and Unit Weight of Soil Specimens
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Methods for Determining the Amount of Material 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 includes 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.

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.

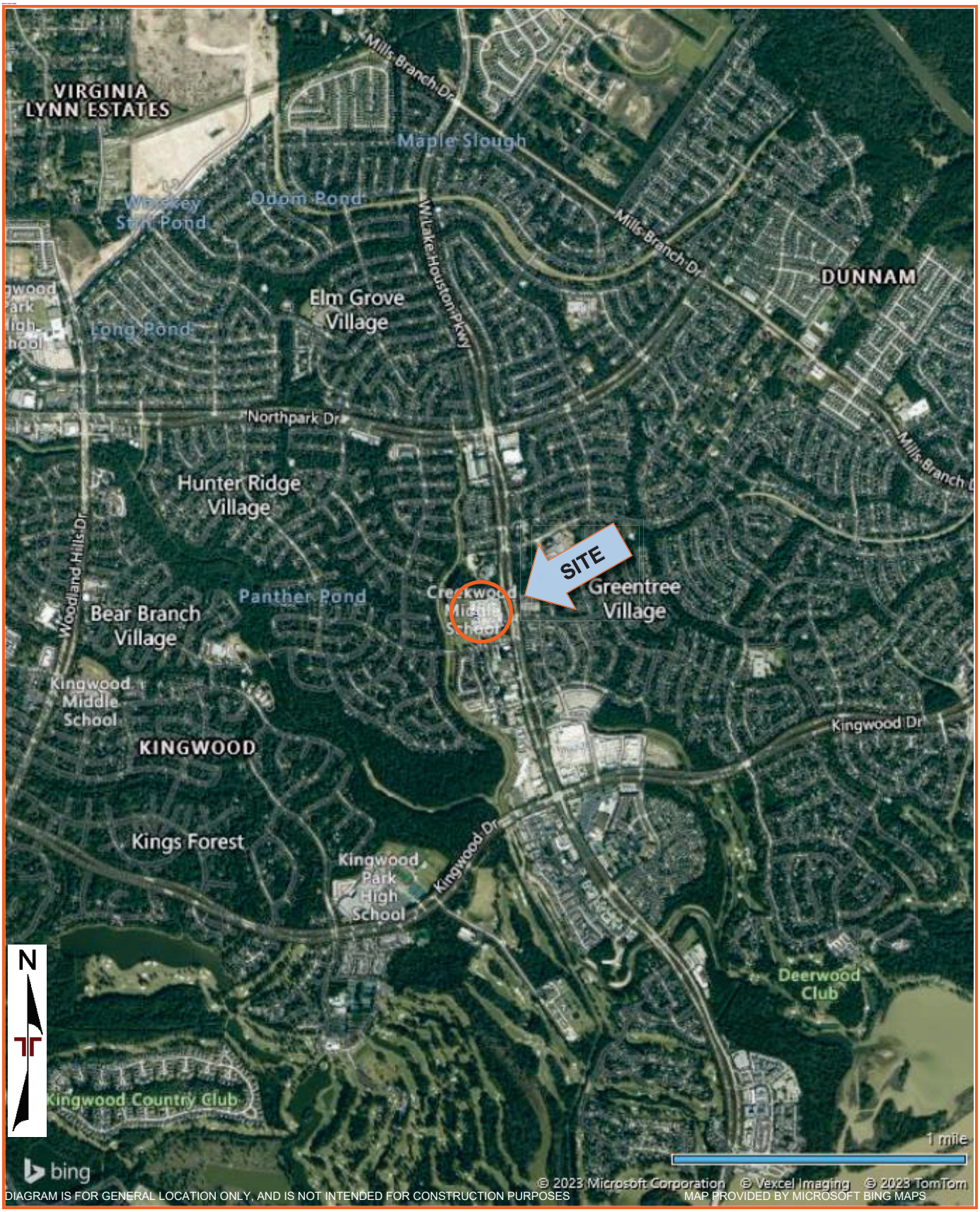
SITE LOCATION AND EXPLORATION PLAN

Contents:

Site Location
Exploration Plan

EXPLORATION PLAN

Humble ISD Creekwood Middle School Additions ■ Kingwood, Texas
July 20, 2023 ■ Terracon Project No. 92235201



EXPLORATION PLAN

Humble ISD Creekwood Middle School Additions ■ Kingwood, Texas

July 20, 2023 ■ Terracon Project No. 92235201

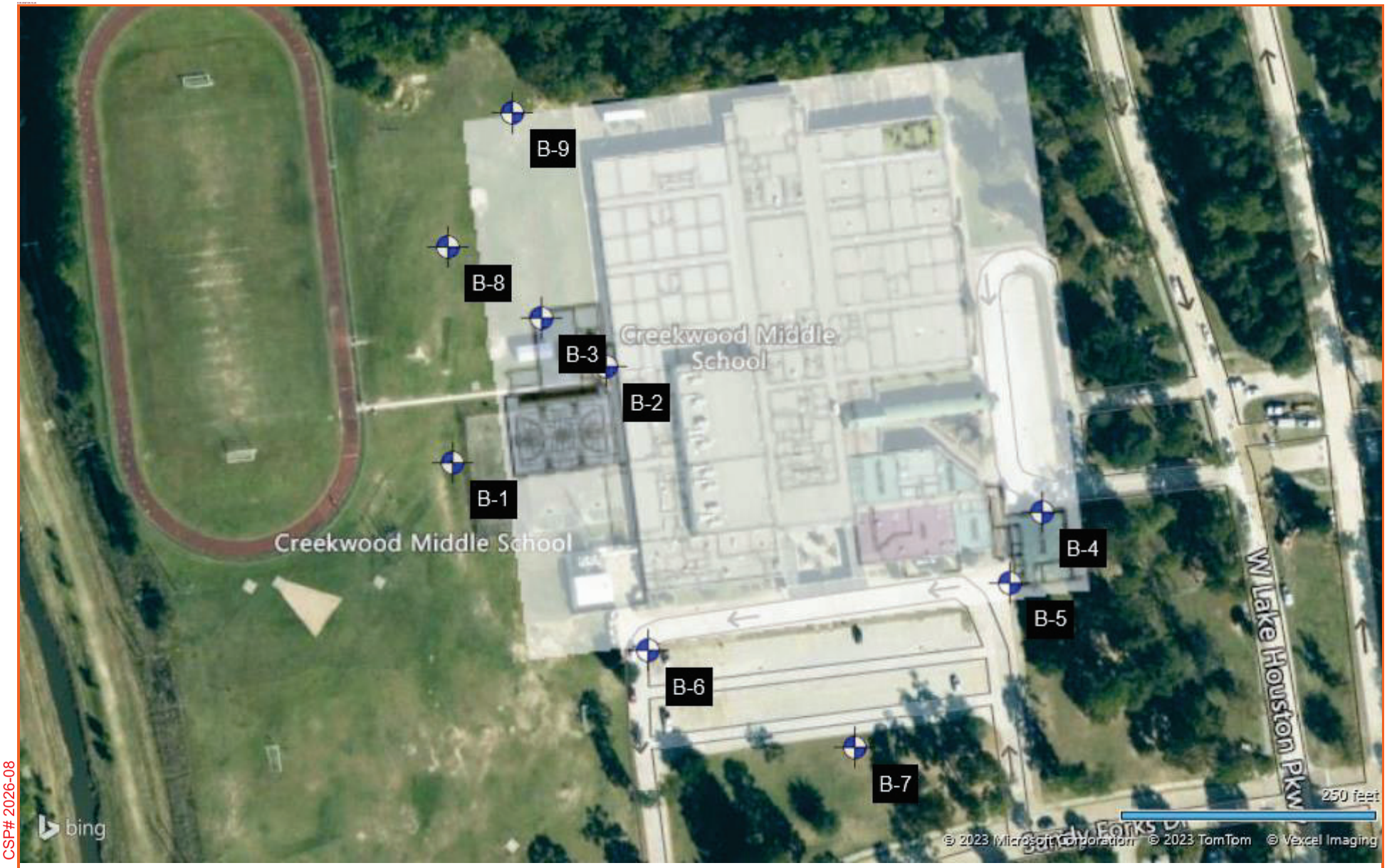


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

CSP# 2026-08

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 and B-9)

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-1

Location: See Exploration Plan
Latitude: 30.0587° Longitude: -95.1894°

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			**FILL - FAT CLAY (CH)**, gray and reddish brown				4.5 (HP)				11.3		53-15-38	68
			- with ferrous stains 2 to 4 feet				4.5 (HP)							
		3.0												
2			**SANDY LEAN CLAY (CL)**, gray, very stiff, with ferrous stains				3.5 (HP)				14.9		27-14-13	
				5			4.25 (HP)							
			- light gray and reddish brown 8 to 13 feet				4.5 (HP)							
				10			4.5 (HP)	UC	2.47	3.2	14.8	112		
		13.0												
4			**SILTY SAND (SM)**, light gray and reddish brown, medium dense				8-8-9 N=17							
				15										
							5-6-7 N=13							
		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
At completion of drilling
Cave-in

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-16-2023

Boring Completed
06-16-2023

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
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Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-2

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0589° Longitude: -95.1891° 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		**FILL - SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to very stiff, with ferrous stains				4.5 (HP)							
		3.0				4.5 (HP)				16.7		40-14-26	
3		**FAT CLAY (CH)**, light gray, stiff, with ferrous stains and sand pockets	5			1.75 (HP)							
						1.25 (HP)				25.6		51-18-33	
2		**SANDY LEAN CLAY (CL)**, light gray and reddish brown,very stiff, with ferrous stains				4.0 (HP)	UC	1.53	5.2	15.2	118		
			10			4.5 (HP)							
						3.0 (HP)							
		18.0	15										
4		**SILTY SAND (SM)**, reddish brown, medium dense				9-10-14 N=24							
		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
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-16-2023

Boring Completed
06-16-2023

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
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Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-3

Location: See Exploration Plan
Latitude: 30.0590° Longitude: -95.1893°

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		0.0	**SILTY CLAY (CL-ML)**, light gray and reddish brown, very stiff				4.5 (HP)				7.9		19-13-6	
		2.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to very stiff				2.0 (HP)							
				5			2.5 (HP)				14.3		39-14-25	
			- light gray, with ferrous stains 6 to 10 feet				2.0 (HP)							
							2.5 (HP)							
				10			4.5 (HP)	UC	1.32	3.6	16.0	111		
		13.0												
4			**CLAYEY SAND (SC)**, light gray, dense, with clay pockets				4.5 (HP)							
				15										
		18.0												
			SILTY SAND (SM), light gray and reddish brown, medium dense				6-9-10 N=19							
		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
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-16-2023

Boring Completed
06-16-2023

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Humble ISD Creekwood Middle School Additions
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-4

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0585° Longitude: -95.1877° 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
4		**SILTY SAND (SM)**, light gray and reddish brown, very stiff, with clay pockets 2.0											
3		**FAT CLAY (CH)**, gray and reddish brown, very stiff, with sand pockets and ferrous stains 4.0				4.5 (HP)				7.7		80-22-58	
2		**SANDY LEAN CLAY (CL)**, gray and reddish brown, very stiff to hard, with ferrous stains	5			4.5 (HP)							
						4.5 (HP)				13.4		45-15-30	
		- light gray and reddish brown, with calcareous nodules 8 to 13 feet				4.5 (HP)	UC	9.57	4.4	12.0	117		59
			10			4.5 (HP)							
		13.0											
3		**FAT CLAY (CH)**, gray and reddish brown, very stiff				4.5 (HP)							
		18.0	15										
		SANDY FAT CLAY (CH), light gray, very stiff				4.5 (HP)							
		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
Truck

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-19-2023

Boring Completed
06-19-2023

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-5

Location: See Exploration Plan
Latitude: 30.0583° Longitude: -95.1878°

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
3			**SANDY FAT CLAY (CH)**, gray and reddish brown, very stiff				4.5 (HP)				20.5		58-16-42	
							4.5 (HP)							
			- light gray and reddish brown 4 to 8 feet	5			4.5 (HP)				16.0		56-16-40	
							4.5 (HP)							
		8.0					4.5 (HP)							
2			**SANDY LEAN CLAY (CL)**, light gray and reddish brown, very stiff to hard	10			4.5 (HP)	UC	8.61	2.5	10.2	118		
			- light gray, with ferrous stains 13 to 15 feet											
				15			4.5 (HP)							
4		18.0	**SILTY SAND (SM)**, light gray, medium dense				7-9-11 N=20							
		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.

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-19-2023

Boring Completed
06-19-2023

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-6

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0582° Longitude: -95.1889° 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		**FILL - FAT CLAY (CH)**, gray, with sand seams 1.0				4.0 (HP)							
2		**LEAN CLAY (CL)**, gray and reddish brown, stiff 4.0				3.0 (HP)				14.2		46-14-32	
3		**SANDY FAT CLAY (CH)**, gray and reddish brown, very stiff 5.0				3.5 (HP)							
		Boring Terminated at 5 Feet	5										

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
Truck

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-19-2023

Boring Completed
06-19-2023

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-7

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0579° Longitude: -95.1883° 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)**, gray and reddish brown, very stiff, with ferrous strains				4.5 (HP)				9.8		24-14-10	
		2.0											
3		**SANDY FAT CLAY (CH)**, gray and reddish brown, very stiff				4.5 (HP)							
						4.25 (HP)							
		5.0	5										
		Boring Terminated at 5 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.

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-19-2023

Boring Completed
06-19-2023

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0592° Longitude: -95.1896° 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 and reddish brown, very stiff to hard				4.5 (HP)							
						4.5 (HP)							
			5			4.5 (HP)	UC	10.00	2.5	10.7	119	37-14-23	
						4.5 (HP)							
						4.5 (HP)							
		10.0	10										
		Boring Terminated at 10 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
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-19-2023

Boring Completed
06-19-2023

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Humble ISD Creekwood Middle School Additions
3603 West Lake Houston Parkway | Kingwood, Texas
CSP# 2026-08
Terracon Project No. 92235201

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-9

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0596° Longitude: -95.1894° 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 and reddish brown, very stiff to hard				4.5 (HP)				15.3			68
						4.5 (HP)							
			5			4.5 (HP)	UC	9.12	2.2	7.2	121		
						4.5 (HP)				13.0		24-14-10	
						4.5 (HP)							
		10.0	10										
		Boring Terminated at 10 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
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
T. Younger

Boring Started
06-16-2023

Boring Completed
06-16-2023

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

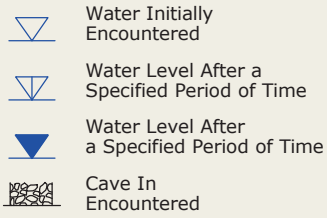
Terracon
11555 Clay Rd, Ste 100
Houston, TX

General Notes

Sampling



Water Level



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.

Field Tests

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

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

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

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
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.

CSP# 2026-08

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]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [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]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [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 on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			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:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[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.

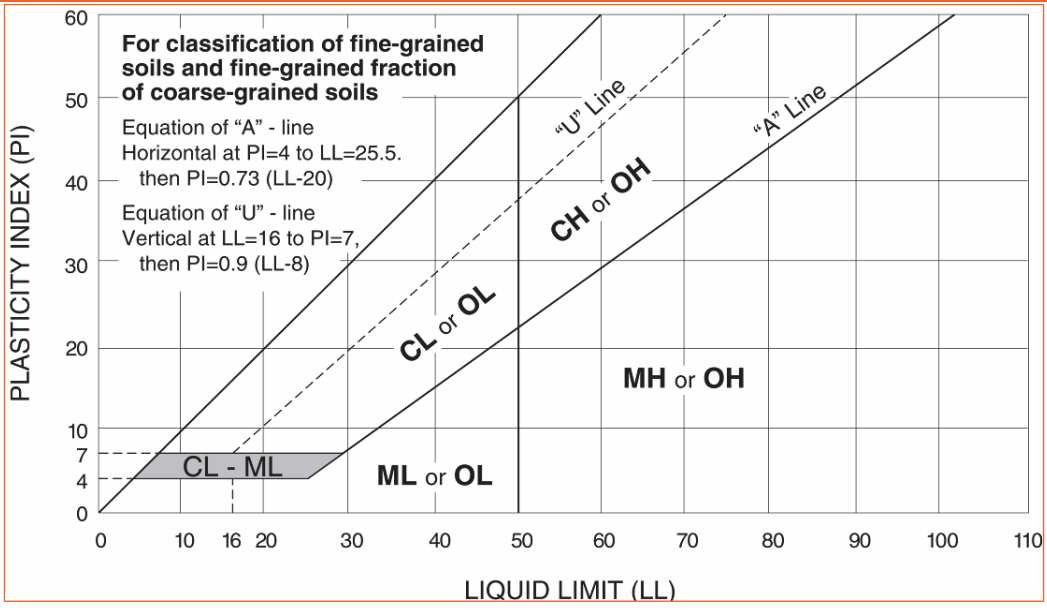
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



CSP# 2026-08

Geotechnical Engineering Report

Humble ISD Riverwood Middle School Additions
Humble, Texas
July 20, 2023
Terracon Project No. 92235207

Prepared for:
Humble Independent School District
Humble, Texas

Prepared by:
Terracon Consultants, Inc.
Houston, Texas

CSP# 2026-08

July 20, 2023

Humble Independent School District
1703 Wilson Road
Humble, Texas 77396

Attn: Mr. Thomas Haggerty
Executive Director of Construction

Re: Geotechnical Engineering Report
Humble ISD Riverwood Middle School Additions
2910 High Valley Drive
Humble, Texas
Terracon Project No. 92235207

Dear Mr. Haggerty:

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the project referenced above in Humble, 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)

Bao Vo, E.I.T.
Staff Geotechnical Engineer

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

STATE OF TEXAS
KARLA I. STRINGER
133252
LICENSED
PROFESSIONAL ENGINEER

Karla I. Stringer, P.E.
Group Manager

REPORT TOPICS

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SITE CONDITIONS 2
PROJECT DESCRIPTION 2
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EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLAN
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
SUPPORTING INFORMATION (General Notes and Unified Soil Classification System)

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report
Humble ISD Riverwood Middle School Additions
2910 High Valley Drive
Humble, Texas
Terracon Project No. 92235207
July 20, 2023

INTRODUCTION

This report represents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements planned within the existing Riverwood Middle School Campus located at 2910 High Valley Drive in Humble, Texas. This project was authorized by Mr. William A. Beattie, Chief Financial Officer of Humble Independent School District (Humble ISD) under the existing Amendment to Contracted Services Agreement, dated April 18, 2023, between Humble ISD and Terracon and through issuance of Purchase Order No. 90440555 on June 6, 2023. This project was performed in general accordance with Terracon Document No. 92235207, dated May 3, 2023

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

- Site and subgrade preparation
- Foundation design and construction
- Detention pond construction considerations
- Pavement design guidelines

The geotechnical engineering Scope of Services for this project included the advancement of nine test borings to depths that ranged from approximately 5 to 20 feet below existing grade.

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

SITE CONDITIONS

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

Item	Description
Project location	The project is within the existing Riverwood Middle School campus located at 2910 High Valley Drive in Humble, Texas. See **Site Location**
Existing improvements	The site is occupied by a one to two-story school building, associated parking and driveway areas, sidewalks, a mechanical area, and light poles.
Current ground cover	Grass, weeds, scattered tress, and rigid and flexible pavements
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	■ A one-story gymnasium and dance support building addition on the northeast side of the existing school building with a footprint area of approximately 15,200 square feet (sf). ■ A one-story band hall building addition on the southwest side of the existing school building with a footprint area of approximately 4,500 sf. ■ Additional parking areas. ■ A detention pond, about 0.2 to 0.3 acres in size, is planned to be constructed with a maximum depth of 6 feet and maximum sideslope declination of 3 Horizontal to 1 Vertical (3H:1V) or flatter. We understand the pond will be owned and maintained by Humble ISD.
Building construction [1]	Either steel-frame or concrete masonry unit (CMU) construction with either a structurally suspended and supported floor slab system or a grade-supported floor slab.
Finished floor elevation [1]	Finished floor elevation is 67½ feet, which is approximately 1½ to 4½ feet above existing grade.

Item	Description
Assumed maximum loads	Grade supported floor slab: ■ **Column loads:** 75 to 100 kips ■ **Floor slab pressure:** 125 pounds per square foot (psf) Structurally suspended and supported floor slab: ■ **Column loads:** 150 to 200 kips
Planned foundation system [1]	Drilled-and-underreamed footings
Pavements	We understand a rigid (concrete) and flexible pavement sections are being considered. 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, and buses from time-to-time in driveway areas.

1. Based on information provided by Huckabee.

GEOTECHNICAL CHARACTERIZATION

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site for the proposed construction is located on the Beaumont formation, a deltaic nonmarine Pleistocene deposit. The Beaumont formation is heterogeneous containing thick interbedded layers of clay, fine sand, and silt.

The clay fraction is primarily composed of montmorillonite, illite, kaolinite, and finely ground quartz. The clay present in the formation has been preconsolidated by a process of desiccation. Numerous wetting and drying cycles have produced a network of small randomly oriented, closely-spaced joints within some depth zones. These small joints frequently have a shiny appearance and the clays are called slickensided in these cases. The joint pattern may have an influence on the construction and engineering behavior of the soil.

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.

Subsurface Profile

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 site preparation and foundation options. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section 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	**Fill: Sandy Lean Clay, Fat Clay, and Sandy Fat Clay**	gray and tan, with sand pockets, and scattered roots and concrete debris
2	**Fat Clay**	gray and tan, medium stiff to very stiff, with sand seams, sand pockets, ferrous stains and nodules, slickensides, and calcareous nodules

Groundwater Conditions

Borings B-1 through B-9 were advanced using dry drilling techniques to their termination depths (approximately 5 to 20 feet) in an effort to evaluate groundwater conditions at the time of the field program. Groundwater was not observed at borings B-1 through B-9 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.

- Fill soils were observed at the ground surface at borings B-1 through B-5, B-8 and B-9 and extended to depths that ranged from about 2 to 4 feet. Fill soils may be present at varying depths and at other locations not explored during our field program. Support of the foundation elements, slabs, flatworks, and pavements on or above fill soils is discussed in this report. However, even with the recommended construction testing services, an inherent risk exists for the owner that compressible fill or unsuitable material

within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill.

- 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 addition 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 drilled-and-underreamed footings may be utilized to support the proposed building additions planned at this site.

- For a grade supported floor slab, a minimum 72-inch thick select fill building pad should be placed under the proposed building additions 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.

- For a structurally supported and suspended floor slab system, a minimum 8-inch void space should be provided beneath the floor slab and grade beams, and the foundation system be designed to carry the floor loads.

- Based on the soil conditions observed at boring B-8 and B-9, which were drilled in the proposed detention pond area, these soils should support sideslopes for the anticipated maximum excavation depth of 6 feet with sideslope declinations of 3H:1V or flatter.

- 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.

- Rigid pavement sections vary from 5.0 to 7.0 inches of reinforced concrete 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 slabs, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, trees, existing pavements, 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 carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Special care should be exercised when proofrolling areas containing fill soils in an attempt to observe soft/weak zones within the fill soils. Weak areas detected during proofrolling, as well as zones of fill 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. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative.

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 D 698) maximum dry density.

Removal of the existing fill and proofrolling in the building addition areas is not required if a structurally suspend and supported floor slab system is utilized for the proposed building additions.

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 building pad under the grade supported floor slab and for all grade adjustments within the building addition areas.
On-site soils	Varies	■ The on-site soils, including the undocumented fill soils, appear suitable for use as fill within the pavement areas, provided they are free of organics and debris. ■ If a structurally suspended and supported floor slab is desired for the proposed building additions, clean on-site soils may be used for grade adjustments under the floor slab.

If blended or mixed soils are intended for use as select fill, Terracon should be contracted 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 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. ■ If a structurally suspended and supported floor slab is desired for the proposed building additions, the on-site soils should be

Item	Description
	compacted to at least 90 to 92 percent of the Standard Effort (ASTM D698) maximum dry density to aid in earth-forming of grade beams, etc. for the structurally suspended floor slab.

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 structure should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building additions. We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the building additions 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 additions during and after construction. Water permitted to pond next to the building additions can result in distress in the building additions. 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 additions for at least 10 feet beyond the perimeter of the building additions. After building construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the building additions should also be periodically inspected and adjusted as necessary, as part of the building additions’ maintenance program.

Planters located within 10 feet of the proposed building additions 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 additions. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the proposed building additions or extend down spouts a minimum of 10 feet away from building additions.

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 additions, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft Subgrade Considerations

Construction operations may encounter difficulties due to wet or soft surface soils becoming a general hindrance to equipment, especially following periods of wet weather. If the subgrade cannot be adequately compacted to the minimum densities as described previously, one of the following measures will be required: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry and improve the condition of the subgrade, or 3) drying by natural means if the schedule allows. Based on our experience with similar soils in this area, chemical treatment is generally an efficient and effective method to improve the condition of wet and weak subgrade. Terracon should be contacted for additional recommendations if chemical treatment is planned to be utilized due to soft and wet subgrade.

FOUNDATION SYSTEM

Based on the subsurface conditions observed during our field and laboratory programs a foundation system consisting of drilled-and-underreamed footings may be utilized to support the proposed building additions planned at this site, provided the subgrade is properly prepared as described in this report. Recommendations for this type of foundation system are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Drilled-and-Underreamed Footings

Description	Design Parameters
Minimum embedment depth [1]	12 feet below the final grade elevation
Allowable bearing pressures [2]	Net dead plus sustained live load – 3,600 psf Net total load – 5,000 psf
Maximum underream-to-shaft diameter ratio	3:1
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

Description	Design Parameters
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 extend through the fill soils and bear within the native undisturbed clay soils.
2. Whichever condition yields a larger bearing area.
3. 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 casing local soil failure to the overlying soils.
4. 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.
5. 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.
6. 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 (new and existing) 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.
7. 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.
8. 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 fill and 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.
9. 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 10 feet below existing 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 and calcareous nodules, 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.

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-Supported Floor Slab System:

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. 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.

Structurally Suspended Floor Slab System:

We understand that a structurally suspended and supported floor slab system may be considered for this project. For a structurally suspended floor slab system at this site, we recommend a minimum 8-inch void space be provided beneath the grade beams.

Proper construction of void space and soils retainers is very important. If a cardboard carton system is used on this project, we recommend that the carton form supplier provide, during initial concrete operations, a representative to instruct the work force on the proper installation methods for both the form and the concrete.

Foundation Construction Monitoring

The performance of the foundation system for the proposed building additions will be highly dependent upon the quality of construction. Thus, we recommend that subgrade preparation, 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 footing 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.

Connection of Building Addition to Existing Building

Based on the information provided to us, we understand that the new building additions are planned to be built immediately adjacent and connected to the existing building. Due to the independence of the existing and proposed foundations systems, differential movements may occur between the foundation systems. The magnitude of the differential movement will be primarily dependent upon the stability of the moisture content of the near-surface soils, the quality of foundation construction and subgrade preparation utilized for the building additions, and the performance of the foundation system of the existing structure. Therefore, any members or connections of the new building additions which are common to the adjacent existing structure should be designed such that they are tolerant to differential movements whenever possible.

FLOOR SLABS

Based on information provided by Huckabee, we understand the finished floor elevation for the building additions is planned to be 67½ feet which is approximately 1½ to 4½ feet above existing grade. If the 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 medium to high expansion potential. These soils can subject the interior floor slab of the building additions 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 additions. 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 4 inches.

We understand a grade supported floor slab system or a structurally suspended and supported floor slab system may be considered for this project. Recommendations for these types of floor slab systems are provided in the following sections.

Grade Supported Floor Slab System

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 structures after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade-supported floor slabs. 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 72 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the building addition areas. This overbuild requirement may be omitted where the building additions are located immediately adjacent to the existing building. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the building additions.

Select fill should be utilized for all grade adjustments within the proposed building area. The subgrade and select fill soils 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 additions 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 additions. If these adjacent flatwork areas are not prepared as stated above the grade supported floor slab, 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 structure) around the perimeter of the building additions.

Structurally Suspended and Supported Floor Slab System

Due to the presence of medium to high plasticity clay soils observed at this site, the most effective means of reducing the effects of floor slab movements resulting from volume changes of the soils would be to structurally suspend the floor slab above grade. For a structurally suspended floor slab system at this site, we recommend a minimum 8-inch void space be provided beneath the floor slab and grade beams, and that the drilled footing foundation system be designed to carry the additional loads.

We also recommend that measures be taken to reduce the possibility of water accumulation in the void space areas below the floor slab and grade beams. In addition, proper ventilation should be provided to minimize the possibility that a high humidity environment could develop in the void space areas.

Proper construction of void space and soils retainers is very important. If a cardboard carton system is used on this project, we recommend that the carton form supplier provide, during initial concrete operations, a representative to instruct the work force on the proper installation methods for both the form and the concrete.

Furthermore, we recommend that at ingress/egress areas (entrances, exits, emergency exits, etc.) around the perimeter of the proposed building additions for the structurally suspended slab be extended at least 5 to 10 feet away from the building to help prevent slab movements from affecting the opening and closing of doors.

DETENTION POND

Based on the information provided to us, we understand that a detention pond is planned to be constructed northeast side of the existing middle school building. We understand that the proposed detention pond is planned to have a maximum depth of 6 feet with sideslopes no steeper than 3H:1V. The following paragraphs present our recommendations regarding excavation of the detention pond, sideslopes, erosion concerns, and potential use of excavated soils as fill.

Excavation and Slopes

Based on the soil conditions observed at borings B-8 and B-9, which were drilled in the proposed detention pond area, the subgrade soils generally consisted of very stiff clay soils. These soils should support sideslopes for the anticipated maximum excavation depth of 6 feet with sideslope declinations of 3H:1V or flatter. If the initial proposed depth of 6 feet is planned to be exceeded or if the sideslopes are planned to be steeper than 3H:1V, Terracon should be notified for additional services.

Groundwater was not observed at borings B-8 and B-9 during or upon completion of drilling. Therefore, groundwater is not expected to be a major concern during construction. However, depending on climatic conditions, groundwater levels may vary from the levels observed during our field program and minor seepage from the inclusions in the near-surface clay soils could be observed within the pond's excavation depth, but we anticipate that the minor seepage can be handled with sumps and pumps positioned in the bottom of the excavations.

The suggested method given above serves as a guideline for groundwater control; other appropriate means may be required for groundwater control during the 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.

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 ponds, piezometers may be installed or trenches or pits may be excavated to the planned excavation depth. Based on those results, the contractor should determine effective methods of groundwater management prior to starting excavation operations.

Erosion

If water flow is permitted along the sideslopes of the ponds, the surficial soils will likely erode, causing gradual steepening and subsequent sloughing of the sideslopes. Therefore, the sideslopes should be protected against sheet flow down the banks or concentrated high velocity water flow. Measures to protect the sideslopes may include slope paving, rip-rap, geofabrics, or even vegetation with an aggressive root system. Routine maintenance of the sideslopes should be performed to reconstruct areas where sloughing and/or erosion have occurred.

Potential Use of Excavated Soils

The subsurface soils observed at borings B-8 and B-9 (within the area of the proposed detention pond) generally consisted of medium to high plasticity clay soils (with plasticity indices

that ranged from 13 to 52 percent) to the anticipated excavation depth (6 feet) of the proposed detention pond.

Excavated soils that meet the select fill criteria (CL or SC with 10≤PI≤20) stated within this report, may be used for grade adjustments within the building addition areas. We recommend that additional testing of the on-site soils within the planned borrow areas be performed to confirm that they consistently meet the select fill criteria. Soils that do not meet the select fill criteria should not be utilized in the building addition areas for grade adjustments. However, soils that do not meet select fill criteria may be considered as general fill material in the pavement areas provided they are free of organics and debris.

PAVEMENTS

Once the subgrade is properly prepared, 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 and 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)

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. 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.

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

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

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 1-2. 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 Treated Subgrade – We anticipate that the pavement subgrade will generally consist of onsite high plasticity clay soils. The pavement subgrade should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. Based on the classification test results, we recommend that about 6 to 8 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 30 to 40 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 this 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

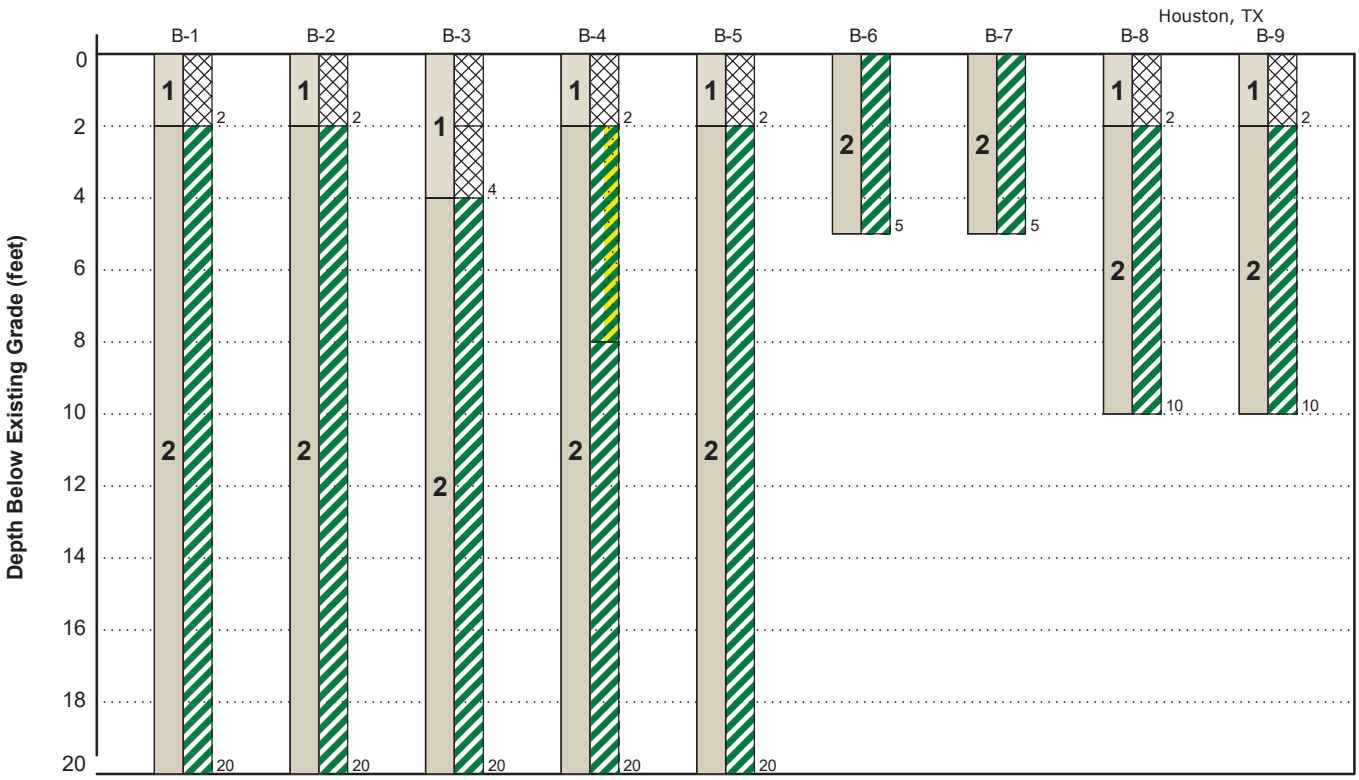
Contents:

GeoModel

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

GeoModel

Terracon
11555 Clay Rd, Ste 100
Houston, TX



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	Fill: Sandy Lean Clay, Fat Clay, and Sandy Fat Clay	gray and tan, with sand pockets, and scattered roots and concrete debris
2	Fat Clay	gray and tan, medium stiff to very stiff, with sand pockets, sand seams, ferrous strains and nodules, slickensides and calcareous nodules

LEGEND

- Fill
- Fat Clay
- Fat Clay with Sand

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.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Boring Location	Number of Borings	Approximate Boring Depth (feet) [1]
Proposed gymnasium and dance support building addition areas	3 (B-1 through B-3)	20
Proposed band hall building addition area	2 (B-4 and B-5)	20
Proposed parking addition areas	2 (B-6 and B-7)	5
Proposed detention pond area	2 (B-8 and B-9)	10

1. Below grade at the time of our field program.

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 a standard truck-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.

Soil samples were 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.

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.

We backfilled the borings with auger cuttings upon completion. Our services did not include repair of the site beyond backfilling our borings, and cold patching the existing pavements. 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, 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 and Unit Weight of Soil Specimens
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Methods for Determining the Amount of Material 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 includes 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.

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 PLAN

Contents:

Site Location
Exploration Plan

CSP# 2026-08

SITE LOCATION

Humble ISD Riverwood Middle School Additions ■ Humble, Texas

July 20, 2023 ■ Terracon Project No. 92235207

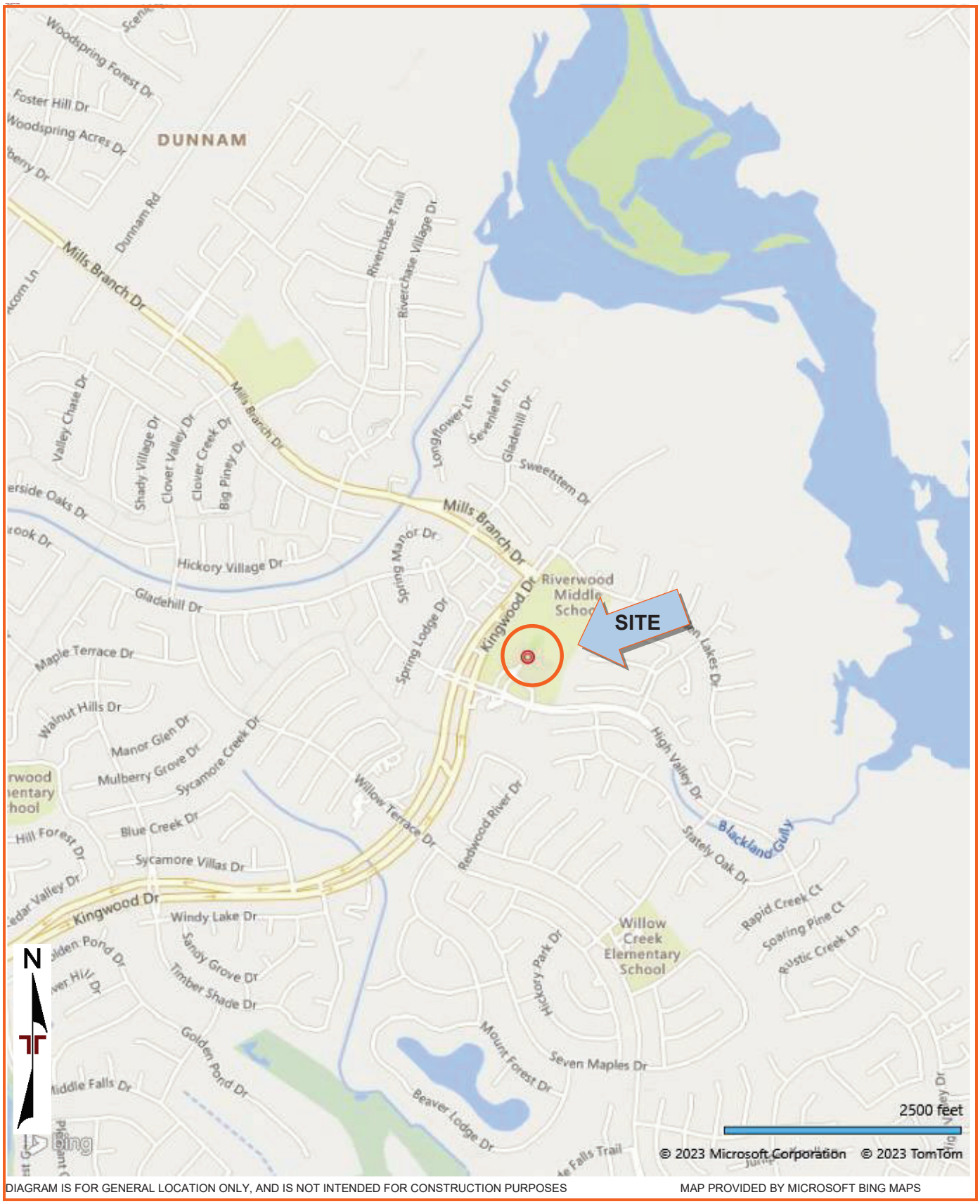


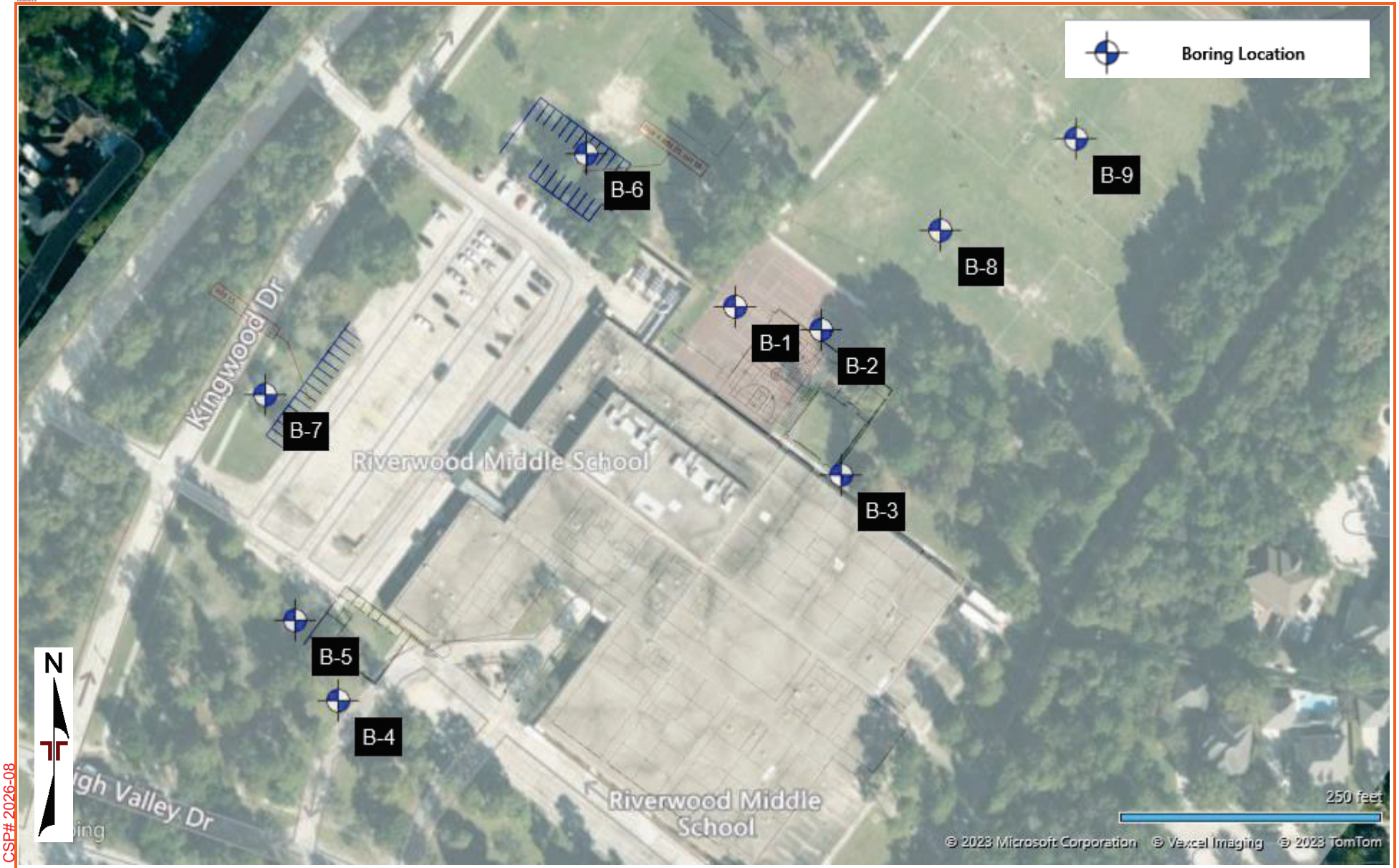
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Humble ISD Riverwood Middle School Additions ■ Humble, Texas

July 20, 2023 ■ Terracon Project No. 92235207



CSP# 2026-08

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 and B-9)

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-.

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0610° Longitude: -95.1556° 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		**FILL - ATCY(LHTC)LT(S)LN** tan, with sand pockets - with scattered concrete debris 0 to 1 feet 2.0				2.5 (HP)							
2		**FTD)LT(S)EN** light gray and tan, stiff to very siff				2.25 (HP)				27.6		72-20-52	95
			5			2.0 (HP)							
						1.75 (HP)				35.1		89-22-67	
		- tan below 8 feet - with slickensides 8 to 10 feet				2.25 (HP)	UC	1.49	3.6	37.6	86		
		- with ferrous stains and calcareous nodules below 10 feet	10			2.75 (HP)							
						3.5 (HP)							
			15										
						4.5 (HP)							
		20.0 ***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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

CBlte

Td|1iatvtilhtlGBd
Dry augered to 20 feet.

Yorcto
Herman Drilling

LBnntd by
T. Younger

Tb1idBivtilhtlGBd
Boring backfilled with auger cuttings upon completion.

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-2

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0610° Longitude: -95.1554° 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		**FILL - ATCY(FTD)LT(S)EN** tan, with sand pockets - with scattered concrete debris 0 to 1 feet 2.0				2.5 (HP)							
2		**FTD)LT(S)EN** gray and tan, medium stiff to very siff				1.75 (HP)							
			5			2.0 (HP)				29.3		64-18-46	
						2.75 (HP)							
		- tan below 8 feet				2.25 (HP)							
		- with slickensides 10 to 13 feet - with ferrous stains and calcareous nodules below 10 feet	10			2.5 (HP)	UC	0.60	1.2	37.5	85		99
						4.0 (HP)							
			15										
						4.5 (HP)							
		20.0 ***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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

Yorcto
Herman Drilling

LBnntd by
T. Younger

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

CBlte

Td|1i atv t i l htlGBd
Dry augered to 20 feet.

Tb1i dBi v t i l htlGBd
Boring backfilled with auger cuttings upon completion.

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0606° Longitude: -95.1553° 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		**FILL - ATCY(LHTC)LT(S)LN**, gray, with scattered roots 2.0				4.5 (HP)							
1		**FILL - FTD)LT(S)EN**, gray, with sand pockets 4.0				4.5 (HP)				12.3		51-18-33	
2		**FTD)LT(S)EN**, gray, stiff to very stiff	5			4.5 (HP)							
2		- light gray below 6 feet				4.5 (HP)				19.4		75-20-55	
2						4.5 (HP)							
2		- with slickensides 10 to 13 feet - with ferrous stains and calcareous nodules below 10 feet	10			4.25 (HP)	UC	1.45	15	35.5	86		
2													
2						4.5 (HP)							
2			15										
2						4.5 (HP)							
2		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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

Yorcto
Herman Drilling

LBnntd by
T. Younger

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

CBlte

Td|1iatv til htlGBd
Dry augered to 20 feet.

Tb1idBi v til htlGBd
Boring backfilled with auger cuttings upon completion.

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
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Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-4

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0600° Longitude: -95.1568° 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		**FILL - ATCY(LHTC)LT(S)LN**, gray, with sand pockets 2.0				4.5 (HP)							
2		**FTD)LT(WIDE ATCY S)EN**, light gray, stiff to very stiff 8.0				4.5 (HP)				13.2		50-16-34	83
			5			4.5 (HP)							
						4.5 (HP)							
		FTD)LT(S)EN, light gray and tan, stiff to very stiff with ferrous stains and nodules, and calcareous nodules				4.5 (HP)							
		- with slickensides 10 to 13 feet	10			4.5 (HP)	UC	1.83	1.1	31.4	90		
			15			4.0 (HP)							
		20.0				4.0 (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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

CBlte

Td|1iatvtilhtlGBd
Dry augered to 20 feet.

Yorcto
Herman Drilling

LBnntd by
T. Younger

Tb1idBivtilhtlGBd
Boring backfilled with auger cuttings upon completion.

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-5

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0602° Longitude: -95.1570° 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		**FILL - ATCY(FTD)LT(S)EN** gray, with sand pockets 2.0				4.5 (HP)							
2		**FTD)LT(S)EN** dark gray, stiff to very stiff, with sand pockets				1.5 (HP)							
		- light gray and tan, with ferrous stains and sand seams 4 to 6 feet	5			1.75 (HP)				20.4		53-15-38	
						2.25 (HP)							
		- tan below 8 feet - with slickensides 8 to 10 feet				4.25 (HP)	UC	2.08	1.5	30.7	94		
		- with ferrous stains below 10 feet	10			4.5 (HP)							
		- with calcareous nodules below 13 feet											
						4.5 (HP)							
			15										
						4.5 (HP)							
		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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

Yorcto
Herman Drilling

LBnntd by
T. Younger

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

CBlte

Td|1i atv t i l htlGBd
Dry augered to 20 feet.

Tb1i dBi v t i l htlGBd
Boring backfilled with auger cuttings upon completion.

Humble ISD Riverwood Middle School Additions
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Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-6

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0614° Longitude: -95.1561° 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		**FTD)LT(S)EN** gray, very stiff, with sand pockets				4.5 (HP)				14.7		53-17-36	
						4.5 (HP)							
		5.0				4.5 (HP)							
		Boring Terminated at 5 Feet	5										

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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

CBlte

Td|1iatv til htlGBd
Dry augered to 5 feet.

Yorcto
Herman Drilling

LBnntd by
T. Younger

Tb1idBiv til htlGBd
Boring backfilled with auger cuttings upon completion.

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-7

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0608° Longitude: -95.1570° 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		**FTD)LT(S)EN** gray, very stiff, with sand pockets				4.5 (HP)							
						2.5 (HP)				18.8		60-19-41	
		5.0				3.0 (HP)							
		Boring Terminated at 5 Feet	5										

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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

Yorcto
Herman Drilling

LBnntd by
T. Younger

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

CBlte

Td|1i atv t i l htlGBd
Dry augered to 5 feet.

Tb1i dBi v t i l htlGBd
Boring backfilled with auger cuttings upon completion.

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0612° Longitude: -95.1550° 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		**FILL - ATCY(LHTC)LT(S)LN** gray, with sand pockets 2.0				2.25 (HP)							
2		**FTD)LT(S)E N** light gray, very stiff				4.5 (HP)				16.1		69-17-52	
		- tan below 4 feet	5			4.5 (HP)							
						2.75 (HP)	UC	2.69	10.2	22.6	104		
		- with ferrous stains below 8 feet				3.25 (HP)							
		10.0	10										
		Boring Terminated at 10 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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

CBlte

Td|1iatv til htlGBd
Dry augered to 10 feet.

Yorcto
Herman Drilling

LBnntd by
T. Younger

Tb1idBiv til htlGBd
Boring backfilled with auger cuttings upon completion.

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

Humble ISD Riverwood Middle School Additions
2910 High Valley Drive | Humble, Texas
CSP# 2026-08
Terracon Project No. 92235207

Terracon
11555 Clay Rd, Ste 100
Houston, TX

MBori n LBn CBgM-9

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0615° Longitude: -95.1546° 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		**FILL - ATCY(LHTC)LT(S)LN** gray, with sand pockets 2.0				4.5 (HP)				10.8		29-16-13	
2		**FTD)LT(S)EN** light gray, very stiff				3.0 (HP)							
		- tan below 4 feet	5			2.5 (HP)							
						2.5 (HP)				22.4		65-15-50	
		- with ferrous stains below 8 feet				3.25 (HP)							
		10.0	10										
		Boring Terminated at 10 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.

W1ltoLt|tcObeto|1lrBi e
No free water observed.

YorccRm
Truck

CBlte

Td|1iatv til htlGBd
Dry augered to 10 feet.

Yorcto
Herman Drilling

LBnntd by
T. Younger

Tb1idBiv til htlGBd
Boring backfilled with auger cuttings upon completion.

MBori n Al1dltd
06-20-2023

MBori n)Bv pdltd
06-20-2023

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

Terracon
11555 Clay Rd, Ste 100
Houston, TX

General Notes

Sampling	Water Level	Field Tests
Shelby Tube	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

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

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

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
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.

CSP# 2026-08

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 on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			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:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[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.

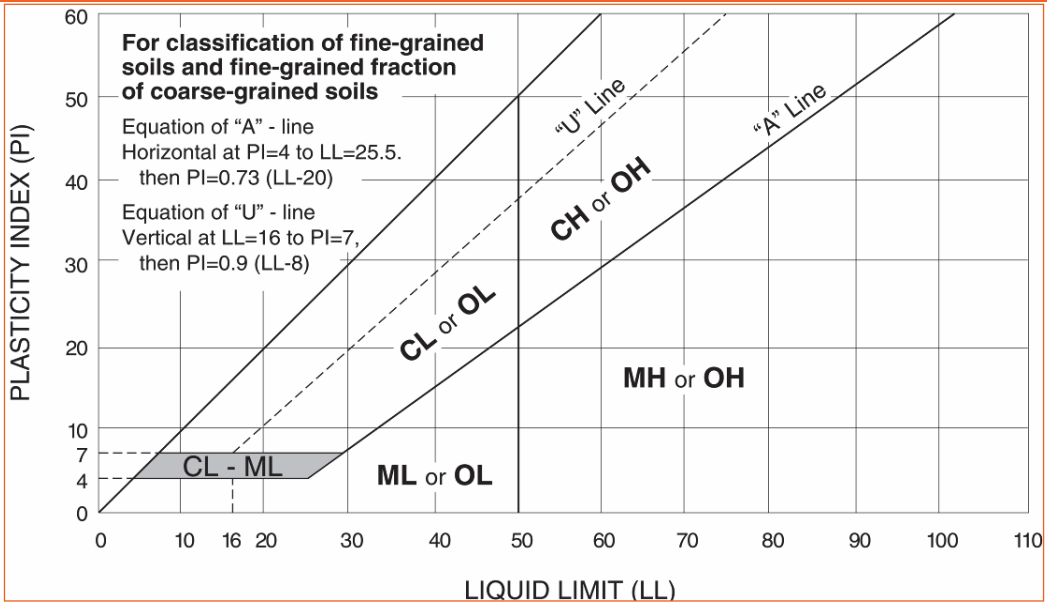
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



SECTION 00 4200
PROPOSAL FORM

PART "A.1" - BASE BID

THIS FORM IS FOR REFERENCE ONLY. RESPONSES SHALL BE COMPLETED IN ION WAVE.

DATE___

2.01 TO:

Dr. Roger Brown, Superintendent of Schools, Humble ISD, Humble, Texas.

A. Having carefully examined the project manual, drawings, and related documents entitled: CSP#: 2026-08; Creekwood and Riverwood Middle School Additions and Renovations as prepared by Huckabee, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all materials, labor and equipment, and perform all work required by the contract documents for the construction of the Creekwood and Riverwood Middle School Additions and Renovations project, in accordance with said documents, of which this Proposal is a part, for the following sum:

B. PROPOSAL ITEM NO. 1: For the construction of Creekwood and Riverwood Middle School Additions and Renovations for Humble ISD in compliance with and as shown on the drawings and herein specified for the sum of:

$_____

C. ALLOWANCES: The Base Bid shall include a total Owners' General Contingency Allowance of $960,000 for both campuses as indicated in Section 01 2100 - Allowances.

D. Estimated Budget: $18,000,000.

E. Substantial Completion: Contract shall be substantially complete on or before September 13, 2027.

F. The undersigned acknowledges _____ addenda to the project manual and drawings/District Purchase Order.

G. The Proposer acknowledges the receipt of the addenda issued on Attributes tab.

H. The undersigned further agrees that the Certified Check, Cashier's Check, or Proposal (Bid) Bond in the amount of five (5%) percent of his Proposal, payable to the Humble ISD, accompanying this Proposal, is left in escrow with the Architect, that it's amount is the measure of liquidated damages the Owner will sustain by the failure of the undersigned to execute and deliver the above-named agreement, or in furnishing the 100% Payment and Performance Bonds within ten (10) days of written notification of the award of the contract to him, then the Certified Check, Cashier's Check, or Proposal Bond shall become the property of the Owner; but if this Proposal is not accepted within sixty (60) days of the time set for the submission of proposals, or if the undersigned executes and delivers said contract and bonds, the check shall be returned to him on receipt thereof.

I. For each day that the completion of the project extends beyond the stipulated completion dates, the 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.

J. If he is notified of the acceptance of this Proposal within sixty (60) days of the time set for the opening of proposals, he agrees to execute a contract for the above work for the above-stated compensation in the form of the Standard Agreement of the American Institute of Architects.

K. The undersigned agrees that the following unit prices may apply on any additions to, or deductions from the work, which prices shall include overhead, profit, taxes, and all other related costs. The unit prices shall be installed, in-place prices for materials/systems as specified. The quoted unit prices will be valid, and the quoted unit prices will be in force on any work. A singular cost shall be provided below to be used for both additions and deductions. If different prices are provided for additions and deductions the average of the absolute values will be used. The materials and work shall be in compliance with the specifications.

2.02 SCHEDULE OF UNIT PRICES

A. UNIT PRICE 1: 4 ½" THICK CONCRETE WALK PER SQUARE FOOT
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 4 ½" thick concrete walk (minimum 100 SF) per Square Foot.
   2. (Add/Deduct)_____Dollars $_____

B. UNIT PRICE 2: 5" THICK CONCRETE DRIVE PER SQUARE FOOT
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.
   2. (Add/Deduct)_____Dollars $_____

C. UNIT PRICE 3: 7" THICK CONCRETE DRIVE PER SQUARE FOOT
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.
   2. (Add/Deduct)_____Dollars $_____

D. UNIT PRICE 4: CURB PER LINEAR FOOT
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 6" high concrete curb per Linear Foot.
   2. (Add/Deduct)_____Dollars $_____

E. UNIT PRICE 5: TRACK SURFACE PER SQUARE FOOT
   1. This unit cost shall establish the amount to the contract price for the Contractor to install a fully assembled track surface per Square Foot.
   2. (Add/Deduct)_____Dollars $_____

F. UNIT PRICE 6: CHAINLINK FENCE
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 6 foot high fence per Linear Foot.
   2. (Add/Deduct)_____Dollars $_____

G. UNIT PRICE 7: PAINTING
   1. This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to paint 100 square feet of wall (minimum 400 square feet of wall).
   2. (Add/Deduct)_____Dollars $_____

H. UNIT PRICE 8: TUBULAR DAYLIGHTING DEVICES in linear metal ceiling
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct a fully functional and assembled unit of 2 daylighting devices in specialty linear metal ceiling.
   2. (Add/Deduct)_____Dollars $_____

I. UNIT PRICE 9: TUBULAR DAYLIGHTING DEVICE
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct a fully functional and assembled unit of 2 daylighting devices in acoustical cloud ceiling.
   2. (Add/Deduct)_____Dollars $_____

J. UNIT PRICE 10: Window SF-R
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct a fully installed SF-R storefront window with masonry sill in a CMU wall construction.
   2. (Add/Deduct)_____Dollars $_____

K. UNIT PRICE 11: ELECTRICAL DUPLEX RECEPTACLE
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct a 20A, 120V duplex electrical receptacle and cover plate, flush mounted in a CMU or, metal stud wall construction.
   2. (Add/Deduct)_____Dollars $_____

L. UNIT PRICE 12: DATA DROP
   1. This unit cost shall establish the amount to the contract price for the Contractor to add or deduct a data drop, flush mounted in a CMU or metal stud wall construction, wired to an IDF/MDF Room.
   2. (Add/Deduct)_____Dollars $_____

END OF SECTION

SECTION 00 4214.10

PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE_____, as Principal, and_____,as Surety, are held and firmly bound unto the Humble Independent School District, Harris County, Texas, hereinafter called the Owner, in the penal sum of_____Dollars ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by the presents.

THE CONDITIONS OF THE OBLIGIATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal, dated_____, being for the Creekwood and Riverwood Middle School Additions and Renovations, the kind and extent of work involved being set forth in detail proposed Contract Documents herein.

NOW THEREFORE, if the Principal shall not withdraw the accompanying proposal within 60 days after the date set for opening thereof, and shall within ten (10) day after the prescribed forms are presented to him for signature, enter into a written contract with the owner in accordance with the Proposal as accepted; and give Bond and good and sufficient surety for the faithful performance and proper fulfillment of such contract including payment of all persons supplying labor or materials therefore, or in the event of the withdrawal of said proposal within the period specified, or the failure to enter into such contract and give such bond within the time specified, if the Principal shall pay to the Owner the difference between aggregate amount for which the Owner may enter into a contract for the same work with another Respondent; if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this_____of_____,20___, the name and Corporate Seal of each corporate party hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

_____ _____
Business Address Individual Principal

_____ _____
Business Address Individual Principal

ATTEST:_____ BY: _____

Secretary President

_____ _____
Business Address Corporate Surety

ATTEST:_____ BY: _____

END OF DOCUMENT

NOTE: THIS INFORMATION MUST BE SUBMITTED ONLINE BY **2:00 PM, THURSDAY, JULY 23, 2026.**

SECTION 00 4333
PROPOSAL FORM PART "A.2" ALTERNATES

THIS FORM IS FOR REFERENCE ONLY. RESPONSES SHALL BE COMPLETED IN ION WAVE.

DATE_____

TO:

Dr. Roger Brown, Superintendent of Schools, Humble ISD, Humble, Texas.

1.01 ALTERNATES

A. Having carefully examined the project manual, drawings, and related documents entitled: CSP#: 2026-08, Creekwood and Riverwood Middle School Additions and Renovations as prepared by Huckabee, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all materials, labor and equipment, and perform all work required by the contract documents for the construction of Creekwood and Riverwood Middle School Additions and Renovations project, in accordance with said documents, of which this Proposal is a part, for the following sum:

B. ALTERNATE NO. 1, BASE BID ADJUSTMENT: The base bid adjustment alternate **will be** applied to the base bid proposal for the purpose of scoring the weighted criteria for price. While other alternates may be accepted or rejected, this alternate will always be accepted and counted in this scoring.

This base bid adjustment alternate shall establish the amount to be added to/deducted from the Base Proposal in the event the Contractor needs to make an adjustment to the Base Bid Proposal submitted at 1:00pm, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

C. ALTERNATE NO. 2A, PARKING ADDITION: Creekwood MS - Provide pricing for; additional parking labeled "INDEPENDENT PRICING" as indicated on sheet G1.02,
(choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

D. ALTERNATE NO. 2B, PARKING ADDITION: Riverwood MS - Provide pricing for; additional parking labeled "INDEPENDENT PRICING" as indicated on sheet G1.02,
(choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

E. ALTERNATE NO. 3, ROOF DAYLIGHTING: Provide pricing to remove all work shown for daylighting devices, roof penetrations, and associated HVAC heat gain at both campuses, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

F. ALTERNATE NO. 4, WINDOWS: Provide pricing to remove all work shown for window openings, and installation at both campuses, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

G. ALTERNATE NO. 5, EXTERIOR DAYLIGHTING: Provide pricing to remove all work shown for new ceilings at both campuses. remove and reinstall as necessary for new fire sprinkler system for both campuses, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

H. ALTERNATE NO. 6, ROOF: Provide pricing to remove roof overhang at GYM &Dance, and drain downspouts underground at both campuses, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

I. ALTERNATE NO. 7, LIGHTING PACKAGE: Eliminate linear fixtures, and remove library lighting upgrade at both campuses, (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

The Proposer has read and understands the Proposal Documents and the Contract Documents and the Proposal is made in accordance with the Proposal Documents.

Respectfully submitted,

Contractor_____

Per_____

END OF SECTION

SECTION 00 4335
PROPOSAL FORM - SCHEDULE AND SUB-CONTRACTOR'S LIST

DATE _____

TO:

DR. ROGER BROWN, SUPERINTENDENT OF SCHOOLS, HUMBLE ISD, HUMBLE, TEXAS.

1.01 THE PROPOSAL RESPONSES SHALL BE RECEIVED VIA HUMBLE ISD'S ONLINE BIDDING SYSTEM UNTIL:

A. Base Bid of the Proposal shall be received until 1:00pm, Thursday,July 23, 2026.

B. Alternates of the Proposal shall be received until 2:00pm, Thursday, July 23, 2026.

1.02 KEY PROJECT PERSONNEL:

Given the scope and schedule of the project, identify all proposed personnel for this project including but not limited to the Project Manager, Estimator, and Superintendent who would work on the project. Provide a resume and references for each individual. Note current projects on which individual is working including the project name, location, contract amount, percent complete, and the completion date of those projects. Also note the length of tenure with your company (hire date) for each proposed individual. Provide an organizational chart for this project noting whether the individual is On Site or Off Site. This organizational chart shall become part of the Owner – Contractor Agreement AIA Document A101. Members of the proposed team, once approved, shall not be changed without prior written approval of the Owner.

1.03 CONSTRUCTION SCHEDULE:

The Proposer shall submit a schedule for this project. Schedule shall be submitted in Gantt Chart format.

State your organization's project plan or proposed approach to this project.

If selected, this proposed schedule shall become part of the Owner – Contractor Agreement AIA Document A101.

1.04 SUBCONTRACTORS:

Provide a list of all the major Subcontractors and Suppliers for each trade for this project on the form attached following this document.

You may provide a maximum of three (3) proposed Sub-contractors for each category. However, no additional Sub-contractors will be considered after submission of this list.

END OF SECTION

LIST OF SUBCONTRACTORS

PROJECT: ARCHITECT:

ARCHITECT'S PROJECT NO.

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

SECTION 00 4393
PROPOSAL SUBMITTAL CHECKLIST

THE FOLLOWING ITEMS ARE TO BE SUBMITTED TO HUMBLE ISD, AS DESCRIBED IN SECTION 00 2116 - INSTRUCTIONS TO PROPOSERS:

1.01 NOTE: ALL PROPOSALS MUST BE ELECTRONIC.

1.02 PROPOSAL FORM: PRE-QUALIFICATIONS

SUBMITTED TO HUMBLE ISD THROUGH THE DISTRICT'S ONLINE BIDDING SYSTEM

A. ( ) Contractor's References – minimum five (5) references including information as outlined in Section 00 4335.

B. ( ) Contractor's Qualification Statement AIA Document A305

1.03 PROPOSAL FORM, RESPONSES AND ATTACHMENTS:

SUBMITTED TO HUMBLE ISD THROUGH THE DISTRICT'S ONLINE BIDDING SYSTEM.

A. ( ) Proposal Form A.1 - Base Bid, **NO LATER THAN 1:00 P.M.**

B. ( ) Proposal Form A.2 - Alternates, **NO LATER THAN 2:00 P.M.**

C. Proposers are to have all forms, required attachments, and all required lines completed and the **SUBMIT RESPONSE** button completed prior to **2:00 PM. on THURSDAY, JULY 23, 2026**, or the system will shut them out and no response will be submitted. Please plan ahead.

END OF SECTION

CSP# 2026-08

DRAFT

AIA® Document A305™ – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)
« »

SUBMITTED TO:
(Organization name and address.)
« »

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)
« »

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

[« »] Exhibit A – General Information
[« »] Exhibit B – Financial and Performance Information
[« »] Exhibit C – Project-Specific Information
[« »] Exhibit D – Past Project Experience
[« »] Exhibit E – Past Project Experience (Continued)

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

_____ « »
Organization's Authorized Representative Signature **Date**

« »
_____
Printed Name and Title

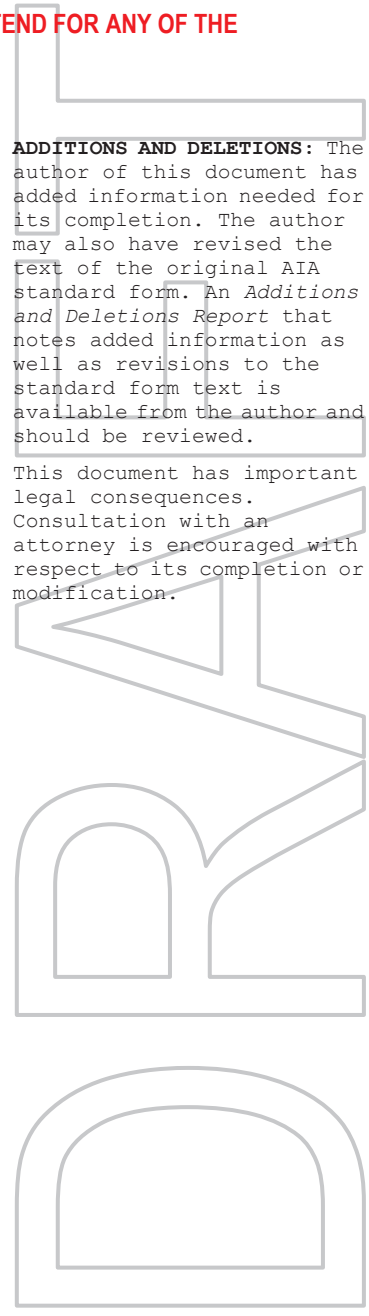
NOTARY
State of: « »
County of: « »
Signed and sworn to before me this « » day of « » « »

_____
Notary Signature

My commission expires: « »

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CSP# 2026-08

DRAFT AIA® Document A305™ – 2020 Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

« »

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

« »

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

« »

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

« »

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

« »

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

« »

.2 If your organization is a partnership, identify its partners and its date of organization.

« »

.3 If your organization is individually owned, identify its owner and date of organization.

« »

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.

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User Notes: (1749899605)

.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

« »

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

« »

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

« »

§ A.1.3.2 How many full-time employees work for your organization?

« »

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

« »

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

« »

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

« »

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

« »

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

« »

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

« »

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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User Notes: (1749899605)

« »

§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

« »

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

« »

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

« »

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

« »

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

« »

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

« »

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

« »

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CSP# 2026-08

DRAFT AIA® Document A305™ – 2020 Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

« »

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

« »

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

« »

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

« »

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

« »

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 failed to complete work awarded to it?

« »

.2 been terminated for any reason except for an owners' convenience?

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.

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User Notes: (1164924504)

« »

.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

« »

.4 filed any lawsuits or requested arbitration regarding a construction project?

« »

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

« »

.2 had any business or professional license subjected to disciplinary action?

« »

.3 been penalized or fined by a state or federal environmental agency?

« »

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CSP# 2026-08

DRAFT AIA® Document A305™ – 2020 Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

« »
« »

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

« »

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

« »

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

« »

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

« »

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

« »

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

« »

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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.

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« »

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

« »

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

« »

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

« »

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

« »

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

« »

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

« »

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

« »

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

« »

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

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§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

« »

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

« »

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

« »

§ C.5.2 Surety company name:

« »

§ C.5.3 Surety agent name and contact information:

« »

§ C.5.4 Total bonding capacity:

« »

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

« »

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DRAFT AIA® Document A305™ – 2020 Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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DRAFT AIA® Document A305™ – 2020 Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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CSP# 2026-08

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the Third day of April in the year Two Thousand Twenty-Five
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Humble Independent School District
10203 Birchridge Drive
Humble, TX 77338

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

Creekwood Middle School & Riverwood Middle School Additions & Renovations Project
Creekwood Middle School ("CMS")
3603 West Lake Houston Pkwy.
Kingwood, TX 77339

Riverwood Middle School ("RMS")
2910 High Valley Dr.
Kingwood, TX 77345

CSP #2025-07

The Architect:
(Name, legal status, address and other information)

Huckabee and Associates, Inc.
801 Cherry Street, Suite 500
Fort Worth, TX 76102

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes 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 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.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

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6 DISPUTE RESOLUTION

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8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[X] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

The date of commencement shall be the day that the Contractor receives a Notice to Proceed from the Owner. If a permit, or other approvals, are not available for the entire Project, the Contractor must commence work on those portions of the Project that do not require a permit or other approvals on receipt of a Notice to Proceed. Work at the Project site shall not begin until Owner has received all required payment and performance bonds and insurance.

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial and Final Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

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(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[X] By the following date: July 01, 2026

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion or Final Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

§ 3.3.4 Subject to adjustments of the Contract Time as provided in the Contract Documents, Final Completion shall be forty-five (45) calendar days after the date of Substantial Completion.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
No. 1: Base Bid Adjustment	
No. 2A: Parking Addition at CMS	
No. 2B: Parking Addition at RMS	

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
	Owner's Contingency Allowance: $960,000.00 for CMS & RMS

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)
Unit Price 1: 4 1/2" thick concrete walk	Unit Price 1: per sq. ft.	
Unit Price 2: 5" thick concrete drive	Unit Price 2: per sq. ft.	
Unit Price 3: 7" thick concrete drive	Unit Price 3: per sq. ft.	
Unit Price 4: Curb	Unit Price 4: per linear ft.	
Unit Price 5: Track surface	Unit Price 5: per sq. ft.	
Unit Price 6: Chainlink fence		
Unit Price 7: Painting		

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Unit Price 8: Turbular daylighting device in linear metal ceiling
Unit Price 9: Turbular daylight device
Unit Price 10: Window SF-R
Unit Price 11: Electrical duplex receptable
Unit Price 12: Data drop

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

$1,500.00 per day as set forth in Paragraphs 8.3.4 and 8.3.5 of the Supplementary Conditions of the A201-2017.

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

N/A

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

N/A

§ 5.1.3 Provided that an Application for Payment is properly executed by the Architect , the Owner shall make payment of the amount certified to the Contractor no later than forty-five (45) days . If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner no later than Forty-Five (45) days after the Architect properly executes the Application for Payment, except that no payment shall be considered not paid when due or past due except in accordance with Section 2251.021 of the Texas Government Code.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, as amended by the Owner, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be providing using the AIA G702 and G703 format and computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;
.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

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.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017, as amended by the Owner;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017, as amended by the Owner; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.6.3 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 If Owner is entitled to deduct liquidated damages, or any other damages or amounts provided in the Contract Documents, including clean-up fees, then the Owner shall be entitled to deduct such liquidated damages, amounts and fees due to the Contractor at any time.

.2 If Contractor fails or refuses to complete the Project or portions of the Work pursuant to Section 3.3.2 and Section 3.3.3, any final payment to the Contractor shall be subject to deduction for such amounts as the Architect and Owner, if applicable, shall determine as the cost for completing incomplete Work.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Final Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

10% if contract valued at < $5,000,000; 5% if contract is valued at $5,000,000+

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

None.

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

Unless authorized in writing by the Owner, retainage is not due and owing until Final Payment.

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Final Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Final Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Final Completion.)

N/A

§ 5.1.8 If Final Completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor amounts due and owing in accordance with Article 9 of AIA Document A201–2017, as amended by the Owner.

§ 5.1.9 Except with the Owner's prior written approval or as otherwise provided in Section 9.3.2 of the AIA Document A2017-2017, as amended by the Owner, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, minus disputed sums, authorized deductions and liquidated damages, shall be made by the Owner to the Contractor after:

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.1 the Contractor has provided all close-out documentation required by the Contract Documents, and fully performed the Contract except for the Contractor's responsibility to correct nonconforming Work as provided in Article 12 of AIA Document A201–2017, as amended by the Owner, and to satisfy other requirements, if any, which extend beyond final payment;

.2 Contractor has submitted a final Application for Payment to the Architect; and has provided all documents required by Section 3.5 and Section 9.10.2 of the AIA Document A201-2017 as amended by the Owner; and

.3 a final Certificate for Payment has been properly executed by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 45 days after the issuance of the Architect's final Certificate for Payment, except that no payment shall be considered not paid when due or past due except in accordance with Section 2251.021 of the Texas Government Code.

§ 5.3 Interest

Undisputed payments due and unpaid under the Contract shall bear interest at a rate set forth by Texas Government Code 2251.021, or similarly applicable law from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

0.00 %

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, as amended by the Owner, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, as amended by the Owner, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017, as amended by the Owner.

§ 7.1.1
INTENTIONALLY DELETED.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017, as amended by the Owner.

ARTICLE 8 MISCELLANEOUS PROVISIONS

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§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Dr. Jason Seybert
Associate Superintendent of Operational Support Services
1703 Wilson, Bldg. B
Humble, TX 773
jason.seybert@humbleisd.net
281-641-871

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 The Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds
§ 8.5.1 The Contractor shall purchase and maintain insurance as set forth in Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6
INTENTIONALLY DELETED

§ 8.7 Other provisions:

As designated by the Owner, Contractor will be responsible for inputting project documentation related to the services provided under this Agreement into the Owner's project management software. Owner will be responsible for providing all necessary licenses.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents; in the event of any inconsistency or conflict between or among the documents that comprise this Agreement, the other of precedence shall be:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, as amended by the Owner
.2 Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 Supplementary Conditions to the AIA Document A201-2017 General Conditions

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

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Number	Date	Pages

Portions of Addenda relating to bidding or competitive purchasing requirements are not part of the Contract Documents unless the bidding or competitive purchasing requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[X] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Supplementary Conditions to the AIA A201-2017 General Conditions	Supplementary Conditions to the AIA A201-2017 General Conditions		24

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

.1 EDGAR Certifications (executed; on file in Purchasing Dept.)
.2 FEMA Certifications (if applicable)
.3 The Project Manual for the Project, including all sections to same, whether issued or created prior to or after the execution of this Agreement.
.4 Statutory Payment and Performance Bonds.
.5 Certificates of Insurance required of the Contractor.
.6 Scale/Schedule of Prevailing Wages.
.7 Modifications to any Contract Documents executed by duly authorized representatives of both the Parties.
.8 Any documents stated in this Agreement as being a part of or incorporated into this Agreement or the Contract.

This Agreement entered into as of the day and year first written above.

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OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
BY: Dr. Roger Brown, Superintendent	BY: TBD
(Printed name and title)	*(Printed name and title)*

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CSP# 2026-08

Additions and Deletions Report for
AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 10:22:52 CDT on 04/04/2025.

Changes to original AIA text

PAGE 2

§ 3.3 Substantial and Final Completion

PAGE 3

§ 3.3.3 If the Contractor fails to achieve Substantial Completion or Final Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

§ 3.3.4 Subject to adjustments of the Contract Time as provided in the Contract Documents, Final Completion shall be forty-five (45) calendar days after the date of Substantial Completion.

Item	Price
No. 1: Base Bid Adjustment	
No. 2A: Parking Addition at CMS	
No. 2B: Parking Addition at RMS	

Item	Price
	Owner's Contingency Allowance: $960,000.00 for CMS & RMS

Item	Units and Limitations	Price per Unit ($0.00)
Unit Price 1: 4 1/2" thick concrete walk	Unit Price 1: per sq. ft.	
Unit Price 2: 5" thick concrete drive	Unit Price 2: per sq. ft.	
Unit Price 3: 7" thick concrete drive	Unit Price 3: per sq. ft.	
Unit Price 4: Curb	Unit Price 4: per linear ft.	
Unit Price 5: Track surface	Unit Price 5: per sq. ft.	
Unit Price 6: Chainlink fence		
Unit Price 7: Painting		
Unit Price 8: Turbular daylighting device in linear metal ceiling		
Unit Price 9: Turbular daylight device		
Unit Price 10: Window SF-R		
Unit Price 11: Electrical duplex receptable		
Unit Price 12: Data drop		

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§ 5.1.3 Provided that an Application for Payment is ~~received~~ properly executed by the Architect ~~not later than the day of a month~~, the Owner shall make payment of the amount certified to the Contractor no~~t~~ later than ~~the~~ forty-five (45) days ~~of the month~~. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner no~~t~~ later than Forty-Five (45) days after the Architect properly executes~~receives~~ the Application for Payment, except that no payment shall be considered not paid when due or past due except in accordance with Section 2251.021 of the Texas Government Code.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.6 In accordance with AIA Document A201™–2017, as amended by the Owner, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be providing using the AIA G702 and G703 format and computed as follows:

PAGE 5

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017, as amended by the Owner;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017, as amended by the Owner; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.6.3 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 If Owner is entitled to deduct liquidated damages, or any other damages or amounts provided in the Contract Documents, including clean-up fees, then the Owner shall be entitled to deduct such liquidated damages, amounts and fees due to the Contractor at any time.

.2 If Contractor fails or refuses to complete the Project or portions of the Work pursuant to Section 3.3.2 and Section 3.3.3, any final payment to the Contractor shall be subject to deduction for such amounts as the Architect and Owner, if applicable, shall determine as the cost for completing incomplete Work.

§ 5.1.7.1 For each progress payment made prior to ~~Substantial~~ Final Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon ~~Substantial~~ Final Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Final ~~Substantial~~ Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon ~~Substantial~~ Final Completion.)

§ 5.1.8 If F~~f~~inal Ceompletion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor ~~any additional~~ amounts due and owing in accordance with Article 9 of AIA Document A201–2017, as amended by the Owner.

§ 5.1.9 Except with the Owner's prior written approval or as otherwise provided in Section 9.3.2 of the AIA Document A2017-2017, as amended by the Owner, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

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§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, minus disputed sums, authorized

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deductions and liquidated damages, shall be made by the Owner to the Contractor after: ~~when~~

.1 the Contractor has provided all close-out documentation required by the Contract Documents, and fully performed the Contract except for the Contractor's responsibility to correct nonconforming Work as provided in Article 12 of AIA Document A201–2017, as amended by the Owner, and to satisfy other requirements, if any, which extend beyond final payment; ~~and~~

.2 Contractor has submitted a final Application for Payment to the Architect; and has provided all documents required by Section 3.5 and Section 9.10.2 of the AIA Document A201-2017 as amended by the Owner; and

.3 a final Certificate for Payment has been ~~rissued~~properly executed by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 45~~30~~ days after the issuance of the Architect's final Certificate for Payment, except that no payment shall be considered not paid when due or past due except in accordance with Section 2251.021 of the Texas Government Code.~~or as follows:~~

Undisputed p~~P~~ayments due and unpaid under the Contract shall bear interest at a rate set forth by Texas Government Code 2251.021, or similarly applicable law from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, as amended by the Owner, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, as amended by the Owner, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017, as amended by the Owner.

§ 7.1.1 ~~If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:~~
~~*(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)*~~*INTENTIONALLY DELETED.*

PAGE 7

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017, as amended by the Owner.

§ 8.4 ~~Neither the Owner's nor t~~The Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5.1 The ~~Owner and the~~ Contractor shall purchase and maintain insurance as set forth in ~~AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum,~~ Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.6 ~~Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with a building information modeling exhibit, if completed, or as otherwise set forth below:~~
~~*(If other than in accordance with a building information modeling exhibit, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)*~~*INTENTIONALLY DELETED*

§ 9.1 This Agreement is comprised of the following documents; in the event of any inconsistency or conflict

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between or among the documents that comprise this Agreement, the other of precedence shall be:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, as amended by the Owner

.2 ~~AIA Document A101™–2017,~~ Exhibit A, Insurance and Bonds

.4 Supplementary Conditions to the AIA Document A201-2017 General Conditions~~Building information modeling exhibit, dated as indicated below:~~
~~*(Insert the date of the building information modeling exhibit incorporated into this Agreement.)*~~

PAGE 8

Portions of Addenda relating to bidding or ~~proposal~~ competitive purchasing requirements are not part of the Contract Documents unless the bidding or ~~proposal~~ competitive purchasing requirements are also enumerated in this Article 9.

Document	Title	Date	Pages
Supplementary Conditions to the AIA A201-2017 General Conditions	Supplementary Conditions to the AIA A201-2017 General Conditions		24

Variable Information

PAGE 1

AGREEMENT made as of the Third day of April in the year Two Thousand Twenty-Five
(In words, indicate day, month and year.)

Humble Independent School District

10203 Birchridge Drive

Humble, TX 77338

Creekwood Middle School & Riverwood Middle School Additions & Renovations Project

Creekwood Middle School ("CMS")
3603 West Lake Houston Pkwy.
Kingwood, TX 77339

Riverwood Middle School ("RMS")
2910 High Valley Dr.
Kingwood, TX 77345

CSP #2025-07

Huckabee and Associates, Inc.

801 Cherry Street, Suite 500

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Fort Worth, TX 76102

PAGE 2

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[X] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

The date of commencement shall be the day that the Contractor receives a Notice to Proceed from the Owner. If a permit, or other approvals, are not available for the entire Project, the Contractor must commence work on those portions of the Project that do not require a permit or other approvals on receipt of a Notice to Proceed. Work at the Project site shall not begin until Owner has received all required payment and performance bonds and insurance.

PAGE 3

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[X] By the following date: July 01, 2026

PAGE 4

$1,500.00 per day as set forth in Paragraphs 8.3.4 and 8.3.5 of the Supplementary Conditions of the A201-2017.

N/A

N/A

§ 5.1.3 Provided that an Application for Payment is properly executed by the Architect , the Owner shall make payment of the amount certified to the Contractor no later than forty-five (45) days . If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner no later than Forty-Five (45) days after the Architect properly executes the Application for Payment, except that no payment shall be considered not paid when due or past due except in accordance with Section 2251.021 of the Texas Government Code.
(Federal, state or local laws may require payment within a certain period of time.)

PAGE 5

10% if contract valued at < $5,000,000; 5% if contract is valued at $5,000,000+

None.

Unless authorized in writing by the Owner, retainage is not due and owing until Final Payment.

N/A

PAGE 6

0.00 %

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

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PAGE 7

Dr. Jason Seybert

Associate Superintendent of Operational Support Services

1703 Wilson, Bldg. B

Humble, TX 773

jason.seybert@humbleisd.net

281-641-871

As designated by the Owner, Contractor will be responsible for inputting project documentation related to the services provided under this Agreement into the Owner's project management software. Owner will be responsible for providing all necessary licenses.

PAGE 8

[X] Supplementary and other Conditions of the Contract:

.1 EDGAR Certifications (executed; on file in Purchasing Dept.)
.2 FEMA Certifications (if applicable)
.3 The Project Manual for the Project, including all sections to same, whether issued or created prior to or after the execution of this Agreement.
.4 Statutory Payment and Performance Bonds.
.5 Certificates of Insurance required of the Contractor.
.6 Scale/Schedule of Prevailing Wages.
.7 Modifications to any Contract Documents executed by duly authorized representatives of both the Parties.
.8 Any documents stated in this Agreement as being a part of or incorporated into this Agreement or the Contract.

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:22:52 CDT on 04/04/2025 under Order No. 20240043200 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ - 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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EXHIBIT A to A101-2017

OWNER'S CONSTRUCTION BOND & INSURANCE REQUIREMENTS

It is suggested that this Exhibit be provided to the Contractor's insurance provider.

Contractor shall not commence work until all required bonds and insurance coverages have been obtained and such insurance has been reviewed and accepted by the District. Certificates of Insurance on the current ACORD form shall be issued to the District showing all required insurance coverages.

Bonds Required

Construction, installation and service contracts (including repair and alteration) exceeding $100,000 requires that a 100% Performance Bond be furnished by the successful bidder (contractor). Contracts exceeding $25,000 require that a 100% Payment Bond be furnished by the successful bidder (contractor). All such bids must include a 5% Bid Bond.

Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of at least A- X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570). The contractor shall be responsible for obtaining bonds and shall absorb any and all costs of such Bonds.

Insurance Required	**Limit Required**
Automobile Liability insurance covering Any Auto	$1,000,000 Combined Single Limit
Comprehensive (Commercial) General Liability insurance including Products, Completed Operations, Independent Contractors, Broad Form Property Damage, Pollution and Blanket Contractual Liability coverages. Any XCU exclusions to be removed when underground work is performed.	$1,000,000 Aggregate, Occurrence and Personal Injury $ 500,000 Fire Damage $ 5,000 Medical Payments Per Project Aggregate (CG 70 49) Evidence of coverage must be shown on certificates of insurance.
Professional Errors & Omissions Liability insurance is required from all professionals consultants; e.g., architects and engineers.	$2,000,000 Per Claim Retroactive Date preceding date of contract must be shown Extended Reporting Period three years past completion of contract
Workers Compensation insurance with limits to comply with the requirements of the Texas Workers' Compensation Act Employers Liability insurance	Statutory Limits $1,000,000
Umbrella or Excess Liability insurance (excess of primary General Liability, Automobile Liability and WC Coverage B)	$5,000,000

Limits for primary policies may differ from those shown when Umbrella or Excess Liability insurance is provided.

All Risk Builders Risk Property Insurance shall be required for all construction contracts when property of the owner is at risk or in the care, custody and control of the Contractor. Builders Risk insurance shall be required for all construction contracts requiring a bond. All Property insurance shall include coverage against the perils of Flood and Earthquake and Domestic Terrorism. (Installation Floater may be substituted when contract involves installation only.)	Contract Limit or Replacement Cost Value of Scope of Work which ever is greater Permission to Occupy granted Deductible: 1% of contract, $50,000 maximum, unless otherwise approved by the Owner.

Insurance Conditions

All insurance coverages shall be issued on an Occurrence basis (except Professional Liability) by companies acceptable to District and licensed to do business in the State of Texas by the Texas Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".

All certificates must include:

1. The location or description and the bid number, CSP number or Purchase Order number,
2. A 60 day notice of cancellation of any non-renewal, cancellation or material change to any of the policies, and copies of CG 02 05, TE 02 02A and WC 42 06 01 or their equivalents specifically naming the District,
3. "Additional Insured" on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District.
4. A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies.
5. In addition to certificates of insurance, copies of policy endorsements specifically naming the District must be provided (a) listing the District as Additional Insured: CG 20 10, CG 20 37, CA 04 03 and (b) showing waivers of subrogation in favor of the District: CG 24 04, TE 20 46A, WC 42 03 04A, or their equivalents.

All insurance must be maintained for one year following substantial completion with Certificates of Insurance provided.

Contractor shall be responsible for payment of all deductibles; the District shall approve the deductibles selected.

If any policy has aggregate limits, a statement of claims against the aggregate limits is required.

The District 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 District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.

CSP# 2026-08

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

Creekwood Middle School & Riverwood Middle School Additions & Renovations Project

Creekwood Middle School ("CMS")
3603 West Lake Houston Pkwy.
Kingwood, TX 77339

Riverwood Middle School ("RMS")
2910 High Valley Dr.
Kingwood, TX 77345

CSP #2025-07

THE OWNER:
(Name, legal status and address)

Humble Independent School District
10203 Birchridge Drive
Humble, TX 77338

THE ARCHITECT:
(Name, legal status and address)

Huckabee and Associates, Inc.
801 Cherry Street, Suite 500
Fort Worth, TX 76102

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes 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 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™–2017, Guide for Supplementary Conditions.

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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 obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the

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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,

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but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 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

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constructed.

§ 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

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Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, 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

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Work, 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.

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§ 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 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.

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§ 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.

§ 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.

§ 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

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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;
- **.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;

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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 proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

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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 procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve

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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

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

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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.

§ 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.

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§ 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 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

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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.

§ 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

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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.

§ 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

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.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.

§ 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

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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.

§ 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

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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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CSP# 2026-08

Additions and Deletions Report for
AIA® Document A201® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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Changes to original AIA text

There are no edits to the original text

Variable Information

PAGE 1

Creekwood Middle School & Riverwood Middle School Additions & Renovations Project

Creekwood Middle School ("CMS")
3603 West Lake Houston Pkwy.
Kingwood, TX 77339

Riverwood Middle School ("RMS")
2910 High Valley Dr.
Kingwood, TX 77345

CSP #2025-07

Humble Independent School District

10203 Birchridge Drive
Humble, TX 77338

Huckabee and Associates, Inc.

801 Cherry Street, Suite 500
Fort Worth, TX 76102

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:35:29 CDT on 04/03/2025 under Order No. 20240043200 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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SUPPLEMENTARY CONDITIONS TO THE AIA DOCUMENT A201-2017 GENERAL CONDITIONS
Owner: Humble Independent School District
Contractor: _____
Project: Creekwood Middle School ("CMS") & Riverwood Middle School ("RMS") Additions & Renovations Project

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.

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, executed EDGAR or FEMA certifications if applicable, and other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract executed 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 A101-2017 or AIA Document A133-2019)
- **.3** The Supplementary Conditions to the AIA A201-2017 as amended by Owner
- **.4** The General Conditions of the Contract for Construction (AIA Document A201-2017)
- .**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 facilitating 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. Either Party may change its address for notice by giving notice of the change of address in accordance with this provision. The Architect must be copied on notices sent to the Owner.

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.

1.9.6 DATE OF AGREEMENT

The date of the Agreement is upon the execution by all Parties. 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, Section 9.10.

1.9.9 DAY

The following days are referenced in the documents:

.1 For the purpose of this agreement, "days" shall be defined as calendar days unless otherwise specified.

.2 Calendar Days. Extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.3 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.

.4 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).

.5 No time extensions will be allowed due to inclement or adverse weather days.

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.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete Section **2.3.6** in its entirety and replace it with the following:

2.3.6 The Contractor will be furnished free of charge 25 copies of the Drawings and 25 copies of the Project Manual. These copies may have been used during the Bid/Proposal process and it is the Contractor's responsibility to determine their completeness and to request replacement of any missing portions. Additional new copies will be furnished at the cost of reproduction, postage, and handling.

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, the Contractor 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 Contractor or 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. As used herein, the term "Contractor" means the Construction Manager-at-Risk under a Construction Manager-at-Risk project.

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, to allow the subcontractor to demonstrate his understanding of the documents to the Architect and to allow the subcontractor to ask for any interpretation he may require.

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, except where a longer period is 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 (including a brief description of

the defect and corrective measures taken). 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, 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 utility charges through Substantial Completion, 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.

.**5** The Contractor shall be responsible for contacting the governing utility authority and/or independent line locating contractor prior to the commencement of any underground digging and shall be responsible for all fees associated. Contractor shall adhere to utility line restrictions identified by the governing utility authority and/or independent line locating contractor. In the event Contractor fails to notify the proper governing utility authority and/or independent line locating contractor or abide by utility line restrictions, Contractor shall be responsible for any and all fees associated with costs to repair damages.

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.

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.

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 a Contract, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path 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 the following clause to Section **3.10.2**:

3.10.2 Requirements for the submittal schedule are outlined in specification section 01 32 00, Construction Progress Schedules. 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 the Contract Sum or extension of the Contract Time based on the time required for review of submittals.

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 and signed as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

.3 Any increases to the Contract Sum based on IFC drawings must be submitted to the Owner for review and approval within thirty (30) days of receipt of IFC drawings from the Architect.

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 Owner, submit all Samples within sixty (60) days of the Notice to Proceed 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 within a schedule mutually agreed upon by the Owner, Architect and MEP Engineer 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; camera the underground plumbing lines to detect and resolve any potential issues and include video in close-out documentation, 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

Add the following Paragraphs in their entirety:

3.19 REPRODUCTIBLE RECORD DRAWINGS

3.19.1 At the completion of the Project, the Contractor shall submit to the Owner one (1) complete set of drawings with all changes made during construction, including concealed mechanical, electrical and plumbing items. Drafting shall be compatible with original drawings and the Contractor shall submit these as hard copies. The record drawings shall exclude the seal of the Architect and/or Engineer and shall have a statement added to indicate the purpose of the drawings (i.e, "RECORD DRAWING"). The Contractor shall also submit to the Owner one (1) mutually agreeable electronic format containing the following:

.1 Final Record Drawings;

.2 Final Specifications;

.3 Copy of final Construction Contract, including all Change Orders.
.4 CPR;
.5 AEA;
.6 Copies of minutes to all Project meetings.

3.19.2 The Contractor shall also provide the Owner with one (1) set of Record Drawings on a mutually agreeable electronic format. The record drawings including specifications shall be 100% complete (including properly dated and executed warranties, complete technical instructions to the Owner, etc.) prior to delivery to the Architect for review. The record documents must be delivered to the Architect thirty (30) days prior to receipt of the Contractor's Final Application for Payment. The record drawings shall exclude the seal of the Architect and/or Engineer and shall have a statement added to indicate the purpose of the drawings (i.e., "RECORD DRAWING").

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 and as noted in the following Wage Rate Scale (See CB-23 through CB-25), for each craft or type of workman or mechanic needed to execute 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, not 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 or Owner 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 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 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.

7.2 CHANGE ORDERS

Add the following Subparagraph 7.2.2:

7.2.2 Methods used in determining adjustments to the Contract Sum shall be determined in one or more of the ways listed below. For deductive change orders, the same amounts used below for markups on additional Work shall also be used for credits on deductions. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected:

.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Where additional Work is involved, any lump sum over the amount of $100.00 shall be broken down to

represent the estimated cast of labor and materials plus mark-ups to cover overhead and profit.

.2 To compensate the Contractor, Subcontractor, or Sub-subcontractor actually performing a part of the Work for the combined cost of overhead and profit, the performing party shall be entitled to a single mark-up not to exceed 10% of the estimated cost of that part of the Work.

.3 To compensate (a) the Contractor for the combined cost of overhead and profit on Work performed by Subcontractors, or (b) Subcontractors for the combined cost of overhead and profit on Work performed by Sub-subcontractors, the Contractor or Subcontractor each shall be entitled to a single mark-up not to exceed 5% of the subcontract amount. On a Construction Manager-at Risk project, the Contractor's markup shall not exceed the CM Fee, and no additional CM Fee shall be permitted on self-performed Work or Work performed by a Related Party.

.4 When a Sub-subcontractor performs the Work of a change, the maximum mark-up not to exceed 10% for combined overhead and profit shall be used only by the Sub-subcontractor. The Contractor and Subcontractor would each be entitled to a single mark-up not to exceed 5% of the cost to them for the Subcontractor and Sub-subcontractor, respectively.

.5 By Unit Prices stated in the Contract Documents or subsequently agreed upon. Additional mark-ups for overhead and profit will not be allowed in Unit Price work.

.6 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee.

.7 Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.2.2 shall be limited to the costs established in Sections 7.3.4.1 through 7.3.4.5.

7.3 CONSTRUCTION CHANGE DIRECTIVES

Delete text of Subparagraph 7.3.3 in its entirety and substitute the following:

7.3.3 The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more ways listed below. For deductive change orders, the same amounts used below for markups on additional Work shall also be used for credits on deductions. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected.

.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Where additional Work is involved, the lump sum shall represent the estimated cost of labor and materials plus markups to cover overhead and profit:

To compensate the Contractor or Subcontractor actually performing a part of the Work for the combined cost of overhead and profit, the performing party shall be entitled to a single markup not to exceed 10% of the estimated cost of that part of the Work.

To compensate the Contractor for the combined cost of overhead and profit on work performed by Subcontractors, the Contractor shall be entitled to a single markup not to exceed 10% of the subcontract amount. On a Construction Manager-at Risk project, the Contractor's markup shall not exceed the CM Fee, and no additional CM Fee shall be permitted on self-performed Work or Work performed by a Related Party.

When a Sub-subcontract performs the Work of a change, the 10% markup for combined overhead and profit shall be used only by the Sub-subcontractor. The Contractor and Subcontractor would each be entitled to a single markup not to exceed 10% of the cost to

them from the Subcontractor and Sub-subcontractor respectively.

.2 By unit prices stated in the Contract Documents or subsequently agreed upon. Additional markups for overhead and profit will not be allowed in Unit Price Work.

.3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee.

Add Section **7.5** as follows:

7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

7.5.1 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 ("CPR"), prior to the commencement of the Work, 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, prior to the commencement of the Work, 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, ten percent (10%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.

7.5.2 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 Construction Manager-at Risk project, the Contractor's markup shall not exceed the CM Fee, and no additional CM Fee shall be permitted on self-performed Work or Work performed by a Related Party.

.2 For Work performed by the Contractor's Subcontractor(s), five percent (5%) of the amount due the Subcontractor(s). On a Construction Manager-at Risk project, the Contractor's markup shall not exceed the CM Fee, and no additional CM Fee shall be permitted on self-performed Work or Work performed by a Related Party

.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, five percent (5%) of the amount due the Sub-subcontractor.

.5 The combined total markup from all categories and tiers above shall not exceed fifteen percent (15%).

.6 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

7.5.3 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.

7.5.4 Change orders, as they are accepted by the Owner, shall be entered under heading "Change Orders" in the next current Request for Payment.

7.5.5 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, including a credit of ten percent (10%) for the Contractor's overhead and profit included in the Contract Sum.

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 Owner determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine. **There shall be no extension of the Contract Time for inclement or adverse weather**. For any excusable delays, Contractor will be solely responsible for its own costs arising in connection with any such delay, and no adjustment will be made to the Contract Sum (including extended general conditions) to account for damages to the Contractor.

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 the Work called for in the Contract Document by the specified dates, 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 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. In the event that Substantial Completion of each portion of the Work as defined in the Contract Documents is not achieved by the date specified for that portion of the Work, liquidated damages as specified in Section 4.5 of the AIA Document A101-2017, Standard Form of Agreement Between Owner and Contractor, as modified by Owner for the Project, shall be deducted from the current and future pay applications for each calendar day beyond that portion's Substantial Completion date until the missed portion of Work is completed. In the event that the Contractor completes the missed portion of Work on or before the next Substantial Completion date, in addition to completing the portion of Work specified for that next Substantial Completion date, the liquidated damages accrued for that specific missed portion of Work may be included in the next pay application for Owner's review and payment pursuant to the terms of this Agreement. Liquidated damages for missed portions of the Work as specified in this subsection shall be in addition to any liquidated damages which may accrue for the failure to reach Substantial Completion of the entire Work. It is expressly understood that said sums per day are 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 sums 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. Except as otherwise provided in the Contract Documents, the liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadlines for substantial completion for all or a portion of the Work 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 for each phase. 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.

Add Sections **8.3.6, 8.3.7, 8.3.8** and **8.3.9** as follows:
8.3.6 Extensions of time granted for causes described herein will be granted on the basis of 1.4 Calendar Days extension for each Regular Working Day lost.
8.3.7 Each Bidder shall include in his proposed Contract Time an adequate allowance of inclement or adverse weather days. **Contractor shall not be entitled to any extension of the Contract Time adjustment to the Contract Sum due to inclement or adverse weather.**

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, 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 No later than 3 working days prior to the first Wednesday of each month, submit an itemized Application for Payment, supported by such data sustaining the Contractor's right to payment as the Owner or Architect may require, and reflecting retainage, as provided elsewhere in the Construction Documents. Information on the form shall be divided into the same last day of the month preceding, which shall also be the basis of payment or as agreed by the Owner, Contractor and Architect by verification at the site, prior to submittal.

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 Surety must agree, in writing, to each request for payment.

.3 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

.4 The Contractor must provide evidence of purchase and delivery in good order without damage, and a certificate of insurance listing Humble ISD as an additional insured, specifically covering the materials or equipment identified by way of serial numbers, bill of lading, and copy of signature of receipt of materials and photography showing materials or equipment.

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 ownership and 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. Security and protection from theft and damage remains on the Contractor as the first line of accountability and financial responsibility. Delays due to issues arising from stored materials shall be not considered as reasonable justification to release the Contractor from meeting the schedule unless the Owner agrees to such delay in writing in advance of any delay. 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 in quadruplicate, 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.

9.7 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 Building Automation Systems must be complete and fully operational and demonstrated to the Owner.
6. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
7. All final lockset cores must be installed and all final Owner directed keying completed.
8. All room plaques and exterior signage must be completed.
9. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
10. 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

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 forty-five (45) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, reviewed and approved by the Architect and Owner, and the Final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions have been satisfied.

ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY

Add Section 10.2.1 as follows:
If a building will be used or occupied by the Owner or members of the public, the Contractor shall be responsible for maintaining safe routes of travel from sidewalks and parking areas to the building and shall notify the Owner in the event rerouting access is necessary to maintain safe access during construction at no additional cost beyond the agreed contract amount.
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, with no extension to the Contract Time or Contract Sum.

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 Section **11.1.1** its entirety and replace with the following:

11.1.1 The Contractor agrees and acknowledges that will comply with and provide all requirements set forth in Exhibit A to the A101 or A133 Agreement (whichever is used for the Project).

Delete the text of Section **11.3** in its entirety.

Delete the text of Section **11.4** in its entirety and replace with the following:

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

Delete the text of Section **11.5** in its entirety. Refer to Exhibit A.

11.6 BUILDER'S RISK COVERAGE

11.6.1 Contractor shall be responsible for obtaining Builders Risk Property Insurance which shall be required for all construction contracts when the property of the Owner is at risk or in the care, custody, and control of the Contractor. Builder's Risk insurance shall be required for all construction contracts requiring a bond. All Property insurance shall include coverage against the perils of Flood and Earthquake and Domestic Terrorism. (Installation Floater may be substituted when contract involves installation only). Coverage limits shall be the Contract Limit or Replacement Cost of Value of Scope of Work, whichever is greater. Permission to Occupy granted. Deductible: 1% of contract, $50,000 maximum, unless otherwise approved by the Owner.

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 01 78 00, Closeout Procedures in Division One for further terms regarding warranties which will be required prior to final payment.

12.2.2 AFTER SUBSTANTIAL COMPLETION

After Section **12.2.2** add the following Section:

12.2.2.1 Approximately 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 **13.7** and **13.8** as follows:

13.7 EQUAL OPPORTUNITY

13.7.1 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.

13.8 CRIMINAL BACKGROUND CHECKS

The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in 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. If Contractor/Subcontractor does not have access to the results of the Criminal Background Check, Contractor/Subcontractor will ensure all documents necessary for use of the Owner's LEE Fast Pass are submitted to the Owner for the required Criminal Background Check.

13.9 REQUIRED CERTIFICATIONS AND VERIFICATIONS

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 further verified

that it is not a prohibited foreign-owned company as defined by Texas Government Code Sections 2274.0101; 2274.0102.

Contractor certifies and verifies that, as defined and set forth in Texas Government Code Chapters 2270, 2271 and 2274, Consultant or any affiliate, subsidiary, or parent company of Consultant, if any, does not boycott Israel, does not boycott energy companies, or discriminate against a firearm entity or firearm trade association; and will not boycott Israel, will not boycott energy companies, or discriminate against a firearm entity or firearm trade association during the term of the contract.

The requirements of the Texas Public Information Act, Chapter 552 of the Texas Government Code, Subchapter J, including requirements to preserve "contracting information defined in 552.003) may apply to this contract if it is valued at more than $1 million.

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 14.1.1 or 14.1.2 exists, the Contractor may, upon seven day's written notice to the Owner 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 Adverse weather conditions shall not be the basis for a Claim for additional time or additions to the Contract Sum.

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.

These Additional Supplementary Conditions are entered into as of the date indicated on the AIA Standard Form of Agreement.

OWNER:

HUMBLE INDEPENDENT SCHOOL DISTRICT

By: _____

Name: Dr. Roger Brown

Title: Superintendent

Date: _____

CONTRACTOR:

_____

By: _____

Name: _____

Title: _____

Date:

SECTION 00 7343
WAGE RATE REQUIREMENTS

WATE RATES

A. Attention is called to the fact that the Contractor must comply with all Federal, State and Local labor laws, including Chapter 2258 Texas Government Code Title 10, which requires that the Contractor pay not less than the following prevailing wage rates and rates for legal holidays and overtime, which have been ascertained by the awarding body, as follows:

DOCUMENT _____
PREVAILING WAGE RATES

A. Pay no less than the wages stated in the Owner's schedule of *Prevailing Wage Rates* bound herein immediately following this Document. No claims for additional compensation will be considered because of payments of wage rates in excess of applicable rates contained therein. If prevailing rates listed are thought to be inaccurate, report suspected discrepancies to the Architect and the Owner.

B. Applicable Statutes: Texas Government Code, Sections 2258.021-.026, 2258.051-.058.

1. A contractor or subcontractor which violates this act shall forfeit as a penalty to the Owner the statutory penalty of sixty dollars ($60.00) per worker for each day or portion of a day said worker is paid less than the applicable stipulated rate for any work done under this Contract.
2. The Contractor and each subcontractor shall keep, or cause to be kept, an accurate record showing the names and occupations of all workers employed in connection with the Work, and showing also the number of hours actually worked per day, the actual hourly rate, and the actual per diem wages paid to each of such workers, which record shall be open at all reasonable hours to the inspection of the Owner.
3. Contractor and each subcontractor shall each complete wage rate surveys on copies of three-page forms available from the Owner, and submit to Owner no later than the submittal of the second application for payment.

C. Prevailing wages shall not be construed to prohibit the payment of more than the rates stated. Under no condition shall any worker employed on this job be paid less than the applicable minimum prevailing wage.

D. Comply with all applicable laws, including but not limited to laws concerned with labor, equal employment opportunity, health and safety, and minimum wages.

E. Apprentice Pay: Only apprentices enrolled in an approved program may be paid apprenticeship rates. Minimum rates for apprentices in all trades and crafts shall be the rates determined by approved apprenticeship programs, or $1.00 per hour less than journeyman's rates, whichever are lower. Approved apprenticeship programs are those approved by the U.S. Department of Labor, Bureau of Apprenticeship Training.

F. Calculation of Rates:

1. Base Per Diem Rate: Multiply hours worked per day by base hourly rate.
2. Overtime (over 40 hours per week, and holidays): multiply base hourly rate by one and one-half (1.5).

G. Prevailing Wage Rate Determination Information:

Prevailing Wage Rate Determination Information

The following information is from Chapter 2258 Texas Government Code:

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.

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.

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.

CSP# 2026-08

Prevailing Wage Rates – School Construction Trades

June 2, 2025

Texas Gulf Coast Area

CLASSIFICATION	2025 HOURLY RATE
ASBESTOS WORKER	$27.20
BRICKLAYER; MASON	$24.90
CARPENTER; CASEWORKER	$23.13
CARPET LAYER; FLOOR INSTALLER	$26.20
CONCRETE FINISHER	$23.83
DATA COMM/TELE COMM	$24.33
DRYWALL INSTALLER; CEILING INSTALLER	$24.33
ELECTRICIAN	$29.86
ELEVATOR MECHANIC	$39.78
FIREPROOFING INSTALLER	$22.99
GLAZIER	$23.25
HEAVY EQUIPMENT OPERATOR	$22.17
INSULATOR	$21.95
IRONWORKER	$26.50
LABORER, HELPER	$19.81
LATHERER; PLASTERER	$22.75
LIGHT EQUIPMENT OPERATOR	$28.75
METAL BUILDING ASSEMBLER	$24.00
PAINTER; WALL COVERING INSTALLER	$20.17
PIPEFITTER	$29.82
PLUMBER	$27.98
ROOFER	$22.50
SHEET METAL WORKER	$29.96
SPRINKLER FITTER	$23.00
STEEL ERECTOR	$26.00
TERRAZZO WORKER	$22.75
TILE SETTER	$22.00
WATERPROOFER; CAULKER	$24.00

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

Asbestos Worker	Worker who removes & disposes of asbestos materials.
Bricklayers/Masons	Craftsman who works with masonry products, stone, brick, block or any material substituting for those materials & accessories.
Carpenter / Caseworker	Worker who builds wood structures or structures of any material which has replaced wood. Includes rough & 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 Communications/ Telecom Installer	Worker who installs data/telephone & television cable and associated equipment and accessories.
Drywall / Ceiling Installer	Worker who installs metal framed walls & ceilings, drywall coverings, ceiling grids
Electrician	Skilled craftsman who installs or repairs electrical wiring & devices. Includes fire alarm systems
Elevator Mechanic	Craftsman skilled in the installation & maintenance of elevators.
Fire Proofing 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-hoe, back-filler, power operated shovel, winch
Insulator	Worker who applies, sprays or installs insulation.
Iron Worker	Skilled craftsman who erects structural steel framing & installs structural concrete
Laborer / Helper	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials & tools, hauling, digging, clean-up.
Lather / Plasterer	Worker who installs metal framing & lath. Worker who applies plaster to lathing and installs associated accessories.
Light Equipment Operator	Includes, but not limited to, air compressors, truck crane driver, flex plane, building elevator, form grader, concrete mixer (less than 14cf), conveyer.
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 & align pumps.
Painter / Wall Covering Installer	Worker who prepares wall surfaces & applies paint and/or wall coverings, tape and bedding.
Pipefitter	Trained worker who installs piping systems, chilled water piping & hot water (boiler) piping, pneumatic tubing controls, chillers, boilers & associated
Plumber	Skilled craftsman who installs domestic hot & cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
Roofer	Worker who installs roofing materials, Bitumen (asphalt & coal tar) felts, flashings, all types roofing membranes & associated products.
Sheet Metal Worker	Worker who installs sheet metal products. Roof metal, flashings & curbs, ductwork, mechanical equipment and associated metals.
Sprinkler Fitter	Worker who installs fire sprinkler systems & fire protection equipment.
Steel Erector	Worker who erects and dismantles structural steel frames of buildings and other structures
Terrazzo Worker	Craftsman who places & finishes Terrazzo.
Tile Setter	Worker who prepares wall and/or floor surfaces & applies ceramic tiles to these
Waterproofer / Caulker	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membrane, liquid membranes, sprayed, rolled or brushed.

SECTION 01 1100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. The "Project" of which the "Work" of this Contract is a part, is titled Creekwood and Riverwood Middle School Additions and Renovations for Humble ISD and is composed of building additions, renovations and related site work located in Humble, Texas.
   2. The "Work" of this Contract is titled Creekwood and Riverwood Middle School Additions and Renovations and is defined in the Contract Documents to include, but not necessarily to be limited to:
      a. Band Hall, Gym, Dance Studio Additions. Renovations: skylights, exterior windows, interior windows, culinary lab, fine arts wing, including all mechanical, electrical, plumbing, and general construction work at each campus.
   3. Related Work:
      a. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.
      b. The work of other contracts is described in various contract documents prepared therefore, some of which are in the possession of the Owner and are available for inspection by interested parties.

B. Other Work:
   1. Owner (if required by Municipality, State or Federal requirements) shall provide evidence to the municipality permitting the project that an asbestos survey has been completed by a person licensed under the Texas Asbestos Health Protection Act to perform such a survey.
   2. The architect has no responsibility for the discovery, presence, handling, removal or disposal of or exposure of persons to hazardous materials or toxic substances in any form at the project site.
   3. The architect is not required to execute certifications that would require knowledge, services or responsibilities beyond the scope of the architectural service agreement.
   4. The architect assists the owner in the owner's responsibility to obtain applicable permits for demolition and construction.
   5. Contractor to review and familiarize themselves with owner's Asbestos survey and plan and shall inform every worker that they use on this project as to the availability of these surveys and plans prior to starting any work.

END OF SECTION

SECTION 01 1400
WORK RESTRICTIONS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. Contractor shall comply with the following requirements concerning scope and work restrictions.
   2. If the Contractor believes that meeting the restrictions in this section would cause a delay to the intended schedule, they shall issue an RFI requesting specific modifications to that specific Work Restriction that would permit construction to continue without delay and indicating the reasons for the request. If construction proceeds without meeting any of the restriction requirements or obtaining approval for a modification of these requirements, the Contractor shall be responsible for all costs associated with removing and replacing all construction that occurred in violation of the Work Restrictions, if directed to by the Architect, without any increase in approved construction costs or schedule for the project.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.
   2. The work of other contracts is described in various contract documents prepared therefore, some of which are in the possession of the Owner and are available for inspection by interested parties.

C. Specific Project Restrictions:
   1. Contractor shall be advised that the school will be operating during the duration of this project.
   2. Contractor shall coordinate with the Owner any activities which will disrupt normal school operations.
   3. Contractor is required to have a Superintendent or elected job captains working under the Superintendent present on site during the duration of the project on all campuses.
   4. Before project completion and a certificate of occupancy is issued, Contractor shall provide fully established grass at locations including but not limited to all disturbed areas, under items that have been stored on site, construction trailers and storage units.
   5. Contractor shall be substantially complete on September 13, 2027.

D. Project restrictions related to Quality Control
   1. The Contractor shall not be permitted to begin work on-site (other than job trailer installation and/or removal of on-site vegetation) until the Contractor has scheduled and hosted a “Foundation Pre-Construction” meeting (in person or on a conference call) with the Architect’s Construction Observer, a representative of the Special Inspection and Testing Agency (SITA), a representative of the Structural Engineer, the Superintendent of Construction, Contractor’s Project Manager, and all foremen for subcontractors with work related to the foundation.
   2. The Contractor shall not be permitted to continue work on-site (other than job trailer installation and/or removal of on-site vegetation) more than one week after the Foundation Pre-Construction meeting (or an alternative deadline if requested by the Contractor and approved by the Architect) unless:

a. The Contractor has obtained correspondence from the Geotechnical Engineer indicating that the Geotechnical Engineering firm has reviewed all relevant Construction Documents for conformance with their recommendations and indicated any portions of these documents which, in their opinion, do not conform with their recommendations. The term "relevant Construction Documents" shall include this Project Manual, all construction drawing sheets, any addenda issued before proposals are received, any addenda issued after proposals are received but before an Owner/Contractor Agreement is fully executed, and any changes in scope associated with a Request For Proposal (RFP) that is approved before construction begins.

b. The Contractor has obtained verification in writing from the Architect that the SITA has issued one or more acceptable statements indicating the SITA will be performing the scope of work for the SITA specified in Section 01 4533 and that the SITA as well as all SITA Staff that will be performing work on this project will meet the qualifications specified in Section 01 4533.

c. The Contractor has obtained verification in writing from the Mechanical and Electrical Engineers that the CxA has issued one or more acceptable statements indicating the CxA will be performing the scope of work for the CxA specified in Section 01 4533 and that the CxA as well as all CxA Staff that will be performing work on this project will meet the qualifications specified in Section 01 4533. This verification shall also confirm that the specified commissioning services on this project comply with the applicable version of the International Energy Conservation Code (IECC).

d. The Contractor has submitted to Humble ISD, the Building Official, and the Architect a written "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control". (Refer to Section 01 4533 for suggested language.)

e. The Contractor has confirmed in writing to the Architect that the Contractor has scheduled and hosted a "Quality Control Pre-Construction Meeting", following the agenda in Section 01 4533, listing the names and project roles of all attendees.

3. The Contractor shall not be permitted to apply for a Certificate of Occupancy until the Contractor has obtained a copy of each Final Report of Quality Control from every firm providing quality control services where required by the Final Report provisions of Section 01 4533 and, in addition, the Contractor has submitted to the AHJ the Final Report of Quality Control from the SITA, the Final Report of Quality Control from the CxA and the Final Report of Quality Control from the Code-Required Structural Observer. (The Contractor shall submit reports from the other quality control personnel if requested by the AHJ.)

E. Project Restrictions related to the General Framing Preconstruction Meeting

1. The Contractor shall not be permitted to install any portion of the superstructure until the Contractor has schedules and hosts a "General Framing Preconstruction Meeting" in which the following people attend: A representative of the Architect, a representative of the Structural Engineer, the SITA, the Superintendent of construction, the Contractor's Project Manager, and all foremen for subcontractors with work related to the framing.

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contingency allowance.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 00 4200 - Proposal Proposal Form

1.03 CONTINGENCY ALLOWANCE

A. Contingency Allowance shall be included in the contract sum.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will not be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Owner's Contingency Allowance: Include the stipulated sum/price of $960,000 for use upon Architect's and Owner's instructions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 2116 - Instructions to Proposers.

B. Document 00 4333 - Proposal Form Part A.2 Alternates.

1.03 PROCEDURES

A. Proposers are required to submit alternate proposals to add work or to deduct work from the base proposal as described below. Failure to submit alternate amounts in spaces provided on proposal form is basis for disqualification of proposal.

B. The successful proposer shall not modify, withdraw or cancel any of the alternate proposals or any part thereof for 60 days after date of receipt of proposals, unless specifically noted otherwise.

C. Contractor shall be responsible for any changes in the work affected by acceptance of these alternates. Include within the alternative proposal prices all costs, including materials, installations, and fees.

D. Claims for additional dollars resulting from changes caused by the alternates will not be allowed.

E. Refer to the drawings and project manual for items of work affected by alternates.

F. Alternates will be exercised at the option of the Owner.

G. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each alternate, when acceptance is designated in the Owner - Contractor Agreement.

1.04 ACCEPTANCE OF ALTERNATES

A. Indicate variation of proposal price for alternates described below and list on the proposal form or any supplement to it, which requests a 'difference' in proposal price by adding to or deducting from the base proposal price or by indicating "No Charge".

B. Indicating "No Bid" as an alternate is unacceptable and is reason for rejection of the proposal.

C. Alternates quoted on Bid / Proposal Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

D. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES

A. See Section "00 4333-Proposal Form Part A.2 Alternates" for Schedule of Alternates.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Schedule of Values.

E. Progress meetings.

F. Submittal Schedule.

G. Submittals for review and project closeout.

H. Number of copies of submittals.

I. Submittal procedures.

J. Progress Payments.

K. Contractor's Daily Field Report.

L. Request For Information.

1.02 RELATED REQUIREMENTS

A. Section 01 1100 - Summary of Work

B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01 6000 - Product Requirements: General product requirements.

D. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

E. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. The Notice to Proceed shall not be issued by the Architect until the Agreement (or Amendment, if Contractor is a Construction Manager at Risk) including final GMP and all exclusions or other post Proposal agreements, have been signed and approved as well as all required payment and performance bonds and insurance, and furnished to the Architect.

B. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

C. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

12. Warranty request and corrective action descriptions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. This includes submittals for review, information, requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), field reports and meeting minutes, preliminary closeout for review, final project record documents closeout submittal and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service at no cost to the Contractor.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Humble ISD's Owner Insite (OI) software.
      a. Contractor will receive a username and password upon award of the project.

C. Training: External user tutorials are availible at www.newforma.com/external-users-tutorials. The awarded General Contractor will be required to become familiar with the program prior to Notice to Proceed being issued.

D. Project Closeout: Architect will determine when to terminate the service for the project. Contractor is responsible for providing digital and hard copies of the final project record documents closeout submittal to the Owner. Should Owner forgo hard copies, Contractor shall submit a credit to the Owner.

3.02 PRECONSTRUCTION MEETINGS

A. A Kick-Off Pre-Construction meeting will be scheduled to be held upon notification by the Architect.
   1. Provide attendance by authorized representatives of the Contractor and major subcontractors.
   2. The Architect will advise other parties, including the Owner, and request their attendance.
   3. The Architect shall arrange, preside, and record the minutes of the pre-construction meeting.
   4. A pre-construction meeting agenda will be issued by the Architect at the meeting.
   5. Agenda items to be discussed include:
      a. Self introductions
      b. Design concept, scope, and objectives
      c. Communications
      d. Contractor’s responsibilities
      e. Documentation and notification

f. Progress Meetings
g. Submittals/Substitutions
h. Project Administration
i. Project Closeout
j. Warranty Phase

B. Foundation Pre-Construction Meeting
1. Before beginning any work on-site (other than job trailer installation and/or removal of on-site vegetation) the Contractor shall schedule and host a “Foundation Pre-Construction” meeting (in person or on a conference call) with the Architect’s Construction Observer, a representative of the Special Inspection and Testing Agency (SITA), the Code-Required Structural Observer, a representative of the Structural Engineer, the Superintendent of Construction, Contractor’s Project Manager, and all foremen for subcontractors with work related to the foundation.

C. Quality Control Pre-Construction Meeting
1. Within one week after the “Foundation Pre-Construction Meeting”, the Contractor shall schedule and host a “Quality Control Pre-Construction Meeting” following the Agenda in Section 01 4533.

D. Framing Pre-Construction Meeting: The Contractor shall not be permitted to install any portion of the superstructure above the foundation until the Contractor has scheduled and held a "General Framing Preconstruction Meeting" in which the following people attend: A representative of the Architect, a representative of the Structural Engineer, the Special Inspection and Testing Agency (SITA), the Superintendent of construction, the Contractor's Project Manager, and all foremen for subcontractors with work related to the framing.

3.03 SCHEDULE OF VALUES AND DRAWDOWN SCHEDULE

A. Within twenty-one (21) calendar days following Notice to Proceed, the Contractor shall submit a Schedule of Values (using the breakdown of the Construction Schedule activities) for review by the Owner’s Representatives. The Schedule of Values will allocate a dollar value (cost) for each activity of the Construction Schedule. Each activity cost allocation shall include a labor, equipment and material cost and a pro rata contribution to overhead and profit. The sum of all activity costs shall be equal to the total Contract Sum. Each activity cost shall be coded with a cost code corresponding to the subcontractor responsible for the Work so that subtotals for each division of the Work can be prepared.

B. Within twenty-one (21) calendar days following Notice to Proceed, the Contractor shall submit a Drawdown Schedule showing anticipated monthly payments from the Owner for coordination of allocated funds for the Project.

C. Within thirty (30) calendar days following Notice to Proceed, the Contractor shall participate in a conference with the Owner’s Representatives to review, evaluate and approve the Schedule of Values and Drawdown Schedule. The approved Schedule of Values and Drawdown Schedule shall, in the best judgment of the Contractor, the Project Manager, and the Architect represent a fair, reasonable, and equitable dollar (cost) allocation for each activity on the Construction Schedule.

3.04 PROGRESS MEETINGS

A. Schedule and administer jobsite meetings throughout progress of the Work in intervals agreed to at the Preconstruction Meeting.

B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings. Agendas and prior meeting minutes shall be distributed 24 hours prior to meeting.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers (as invited), Owner, Architect, as appropriate to agenda topics for each meeting. Representation should be consistent throughout project.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Status of Request for Information (RFI).
   14. Status of Request for Change Proposal (RFP).
   15. Other business relating to work.
   16. Construction forecast for 3 weeks.
   17. Weather Delay Requests.
   18. Quality Control.

E. Record minutes and distribute typewritten copies within two days after meeting to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.
   1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
   2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

3.05 SUBMITTAL SCHEDULE

A. Within twenty-one (21) business days following the Notice to Proceed, the Contractor shall submit a Submittal Schedule for review by the Architect and Owner. This schedule shall coincide with the approved Construction Schedule accommodating the submittal review and material selection times as required by Architect, Owner or Owner’s Representatives. In the event a submittal schedule is not provided and approved by the Architect, Owner, or the Owner's Representative at the submission of the 2nd pay application, the 2nd pay application will be held until the submittal schedule is complete as noted above.

B. This schedule shall list all required submittals, product data, and samples for the project. Each item to be submitted shall include the date to be submitted, review time and the scheduled installation date. All submittals shall be listed and sequenced within the Submittal Schedule in accordance with the approved Construction Schedule.

C. The Architect and Owner will review the Submittal Schedule, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised Submittal Schedule to the Architect and Owner within fourteen (14) business days and thereafter until approved,

D. Submittals, product data and samples submitted out of sequence to the approved Submittal Schedule or Construction Schedule will be subject to return as unchecked and required to be resubmitted at a date coinciding with these schedules. The Submittal Schedule is advisory only and shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every Contract required Milestone and Completion date. Omissions and errors in the approved Submittal Schedule shall not excuse the Contractor from providing required submittals, product data or samples, nor excuse the Contractor from meeting the Contract required Milestones and Completion date.

3.06 SUBMITTAL DEFINITIONS AND REQUIREMENTS

A. Shop Drawing
   1. Shop drawings, diagrams, schedules and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.

B. Product Data
   1. Product data are illustrations, standard schedules, performance charts, instructions, and brochures, furnished by the contractor to illustrate materials or equipment to illustrate some portion of the work.

C. Sample
   1. Physical examples which illustrate materials for some portion of the work evaluated for product compliance.

D. Color Sample
   1. Physical examples which illustrate color or texture for use in color selection.

E. Submittal
   1. The submittal is the compilation of the shop drawing, product data, sample, color sample as requested by the specifications.

3.07 SUBMITTALS FOR REVIEW

A. Submittals to the Architect which are not listed below will not be reviewed by the Architect and will not be returned to the Contractor. Submittals required by specification section which are not listed in this section shall be reviewed by the Contractor.

B. The Architects review of the Contractors submittal shall be limited to examination of an initial submittal and one resubmittal. The Architect's review of additional submittals, beyond that of the initial and resubmittal, will be made only with prior written approval of the Owner after notification by the Architect.

C. Contractors review of submittals shall be consistent with A201 – General Conditions. Areas of deviation from the Contract Documents will be represented by revision clouds, Green in color, made by the General Contractor on the associated PDF document. In the event there are no clouded areas identified, it can be assumed that the associated submittal has been reviewed in full by the General Contractor and are deemed approved. No further review by the Architect is required.

D. Samples
   1. Contractor shall submit all products which require a color selection. Contractor shall only submit actual product sample. Remainder of submittal shall be retained by contractor. Refer to color sample procedures below.
   2. Provide sample identical to the precise article proposed to be provided. If actual sample is not provided for substitution review, submittal will be rejected.
   3. Unless otherwise specified, submit one sample which will be retained by the Architect.
   4. Samples will be reviewed only for aesthetic, color, or finish selection.

E. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the project, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect.

F. Where required by specification sections, provide submittals to the Contractor for review and approval. Contractor shall maintain a copy of all submittals at the project site.

G. Fax submittals are not acceptable.

H. Upon request by the Architect, Contractor shall submit additional items as required.
   1. Only the following listed items shall be submitted to the Architect for review:
      a. Division 03 - Concrete
         1) Product Data – all components required per spec section.
         2) Shop Drawings – all components required per spec section.
      b. Section 04 0511 - Mortar and Masonry Grout
         1) All proposed mortar and grout mix designs
      c. Section 04 2000 - Unit Masonry
         1) Reinforcement Shop Drawings
      d. Section 04 7200 – Cast Stone Masonry
         1) Shop drawings with seal of professional engineer (Texas).
      e. Division 05 - Metals
         1) Product Data – all components required per spec section.
         2) Shop Drawings – all components required per spec section.
      f. Division 07 - Thermal and Moisture Protection
         1) Product Data – all components required per spec section.
         2) Shop Drawings – all components required per spec section.
      g. Division 08 - Openings
         1) Product Data – all components required per spec section.
         2) Shop Drawings – all components required per spec section.
      h. Section 09 3000 – Tiling
         1) Shop drawings – all components required per spec section.
      i. Section 09 5100 – Acoustical Ceilings
         1) Product Data – all components required per spec section.
         2) Shop drawings – all components required per spec section.
      j. Section 09 6466 – Wood Athletic Flooring
         1) Product Data – all components required per spec section.
         2) Shop drawings – Court layouts/markings.
      k. Section 09 6816 – Sheet Carpeting
         1) Shop drawings – all components required per spec section.
      l. Section 09 7223 – Custom Digital Wall Covering
         1) Product Data – all components required per spec section.
         2) Shop Drawings – all components required per spec section.
      m. Section 09 8400 – Acoustical Panels
         1) Product Data – all components required per spec section.
         2) Shop drawings – all components required per spec section.
      n. Section 10 1100 – Visual Display Units
         1) Product Data – all components required per spec section.
         2) Shop drawings – all components required per spec section.
      o. Section 10 1400 – Signage
         1) Shop Drawings and sign copy layout
         2) Product Samples
      p. Section 10 2113.19 - Plastic Toilet Compartments
         1) Product Data – all components required per spec section.

2) Shop drawings – all components required per spec section.

q. Section 10 2123 - Cubicle Curtains and Tracks
   1) Shop drawings – all components required per spec section.

r. Section 10 7113.43 – Fixed Sun Screens
   1) Product Data – all components required per spec section.
   2) Shop drawings with seal of professional engineer (Texas).

s. Section 10 8213 - Roof Screens
   1) Product Data – all components required per spec section.
   2) Shop drawings – all components required per spec section.

t. Section 11 4000 – Food Service Equipment
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.
   3) Parts Manuals - required for all equipment.

u. Section 11 6623 – Gymnasium Equipment
   1) Product Data – all components required per spec section.
   2) Shop Drawings - all components required per spec section.

v. Section 11 6843 – Scoreboards
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

w. Section 11 6833 – Athletic Field Equipment
   1) Product Data – all components required per spec section.

x. Section 12 2400 - Window Shades
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

y. Section 12 3200 - Manufactured Wood Casework
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

z. Section 12 3551 - Music Instrument Storage
   1) Product Data – all components required per spec section.
   2) Shop drawings – all components required per spec section.

aa. Section 12 3600 - Countertops
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

bb. Section 12 6613 - Telescoping Bleachers
   1) Product Data – all components required per spec section.
   2) Shop drawings – all components required per spec section.

cc. Section 14 4600 - Material Lifts
   1) Product Data – all components required per spec section.
   2) Shop drawings – all components required per spec section.

dd. Divisions 21, 22, 23, 26, 27, 28
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

ee. Division 31 - Earthwork
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

ff. Division 32 - Exterior Improvements
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

gg. Division 33 - Utilities
   1) Product Data – all components required per spec section.
   2) Shop Drawings – all components required per spec section.

2. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
3. Samples will be reviewed only for aesthetic, color, or finish selection.
4. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Within sixty (60) days following the Notice to Proceed, the Contractor shall submit a list of Expected Closeout Documents for review by the Architect. This list shall include project record documents, operation and maintenance data, warranties, bonds, contract forms, health/safe environment data, attic stock sign offs, Owner training, certifications and inspections, and other types as indicated. All items on the list shall be titled with spec section number and general description - Example: "09 3000 Tiling - 1 year warranty".

B. The Architect will review the list of Expected Closeout Documents, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised list to the Architect and Owner within fourteen (14) business days and thereafter until approved.

C. Contractor may submit Closeout Documents by Specification Division in full as scopes of work are completed.

D. Submit Correction Punch List for Substantial Completion.

E. Submit Final Correction Punch List for Substantial Completion.

F. Submit for Owner's benefit during and after project completion.

G. See Section’s 01 7000 and 01 7800 for additional details.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 01 7800.

C. Samples: Submit one sample as specified in individual specification sections which will be retained by Architect. All other samples required by the individual specification section shall be retained by the Contractor.
   1. After review, Contractor shall produce duplicates if needed for other purposes.
   2. The Architect’s sample will not be returned to Contractor.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Transmit using approved form.
   2. Acceptable Manufacturers
      a. Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification. For additional manufacturers requiring approval, reference Section 01 6000 – Product Requirements.
   3. Sequentially identify each item. For revised submittals use original number and a sequential alphabetical suffix.
   4. Submittals shall be numbered as follows:
      a. Number shall be Architects project number followed by the appropriate specification section - consecutive submittal number for section.
      b. Example - 1234-01-01 Tiling 09 3000 - 5.
      c. When material is re-submitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
      d. On re-submittals, cite the original submittal number for reference.

e. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
f. When multiple projects are administered under one contract, contractor shall submit separate submittals for each project. Failure to submit separately will result in a rejected submittal review.
g. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
1) Partial submittals may be rejected as not complying with the provisions of the Contract.
2) The Contractor may be held liable for delays so occasioned.
3) Multiple projects bid under a single prime shall package submittals separately for each project.

5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
a. Upload submittals in electronic form to Electronic Document Submittal Service website.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Revisions:
a. Make revisions required by the Architect.
b. If the Contractor considers any required revision to be a change, he shall so notify the Architect as provided for in the General Conditions.
c. Make only those revisions directed or approved by the Architect.
d. The contractor shall be responsible for delays caused by rejection of inadequate or incorrect submittals.
13. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
14. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
15. Submittals not requested will not be recognized or processed.

B. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.11 ELECTRONIC DRAWING FILE REQUEST

A. Upon Award of Contract:

1. At the pre-construction meeting, Awarded Prime Contractor shall bring the executed electronic file release form for the original contract documents. The agreement forms can be found at the end of this Section. Upon the Prime Contractor executing and submitting the agreement to the Architect, the Architect will provide the Contractor one (1) electronic copy of the Revit® BIM Model file(s) **at no charge** within five (5) working days. **Note that CAD files associated with the work can be accessed and exported from the model provided to the General Contractor through the use of Revit® software; therefore, individual CAD files will not be provided by the Architect or its consultants**. Files and Formats to be as follows
   a. Civil: Overall master file in AutoCAD format.
      1) Overall site plan with utility and grading information
      2) All details, detail annotation and references are omitted and not part of the AutoCAD file.
   b. Structural: BIM Model (Revit) and associated working plan views.
      1) Plan views contain overall and enlarged plan section view set up of foundation, second floor framing and roof framing only. All plan views contain grids, dimensions and general annotation.
      2) All details, detail annotation and references are omitted and not part of the model file.
   c. Architectural: BIM Model (Revit) and associated working plan views.
      1) Project Specific BIM Dataset will include information pertaining to the Architectural Building Information Model including model(s), schedules, views, sheets, and details.
      2) All “working” views will be omitted and Huckabee title blocks will be replaced with Huckabee CONTRACTOR Title Block
   d. Mechanical, Electrical and Plumbing: BIM Model (Revit) and associated working plan views.
      1) Plan views contain overall and enlarged section plan view set up of mechanical, electrical lighting, electrical power and plumbing plans only.
      2) All details, detail annotation and references are omitted and not part of the model file.
   e. Technology: BIM Model (Revit) and associated working plan views.
      1) Plan views contain overall and enlarged section plan view set up showing all device locations and general annotation.
      2) All details, detail annotation and references are omitted and not part of the model file.
      3) Electronic files for Technology drawings will only be released to the Prime Contractor but will require signatures from both the Prime Contractor and the Technology Subcontractor on an additional Technology/Security release form.
2. The Revit® file provided to the Awarded Prime Contractor is NOT FOR CONSTRUCTION PURPOSES, but for convenience only. This BIM Model will consist of the original model utilized for base bid. It is the responsibility of the Awarded Prime Contractor to coordinate all accepted alternates, addenda, Requests for Information, Proposal Requests and any other changes realized during construction. The Architect will not provide up-to-date drawings sets or updated BIM Models to the Awarded Prime Contractor unless otherwise stated within the Owner/Architect agreement. If “conformed” documents are required by the Owner/Architect agreement they will be provided in (PDF) Portable Document Format. Conformed Construction Documents are the Construction Documents modified to include any addenda issued during the bidding or negotiation process. The AIA does not use the terms “conform set” or “conformed set” in its documents.
3. TO THE EXTENT CONFORMED CONSTRUCTION DOCUMENTS ARE PROVIDED TO THE CONTRACTOR REGARDING THE PROJECT, THE FOLLOWING PROVISIONS SHALL APPLY:

a. The Conformed Construction Documents and related information contained therein, are provided for the Contractor's (CONTRACTOR) convenience only, and does not relieve the CONTRACTOR from the requirements of Contract Documents which were issued for bid including any addenda. Specifically, to the extent that any discrepancy or conflict exists between the Issue for Bid documents including any Addenda (collectively referred to as the "Bid and Addenda Documents") on the one hand, and the Conformed Construction Documents on the other, the Bid and Addenda Documents shall control unless otherwise specified in writing by the Architect. Field verification of existing and as-built conditions are required as part of the submittal process as specified in this Section 01 3000 Administrative Requirements and Section 01 7000 Execution and Closeout Requirements.
b. CONTRACTOR shall not to use such drawings, documents, or other data, in whole or in part, for any purpose or project other than the "PROJECT" in the preparation of shop drawings and other submittals.
c. CONTRACTOR acknowledges that such drawings, documents, and other data are subject to change or modification. CONTRACTOR shall be responsible for updating any drawings, documents or other data obtained prior to use by them for any purpose.
d. Any Conformed Construction Documents, including any drawings, documents, or other data related thereto, are provided, "AS IS" without representation or warranty by Architect, either express or implied.
e. CONTRACTOR acknowledges that Conformed Construction Documents are being provided by ARCHITECT as a courtesy to CONTRACTOR, at their specific request, and accordingly CONTRACTOR DOES HEREBY AGREE TO RELEASE, HOLD HARMLESS, DEFEND AND INDEMNIFY ARCHITECT AND THE HUMBLE ISD (OWNER), FROM ANY AND ALL CLAIMS, DEMANDS, OR CAUSES OF ACTION, WHICH CONTRACTOR, OR ANY THIRD PARTY, MAY HAVE BY REASON OF ANY INJURY OR DAMAGE SUSTAINED BY CONTRACTOR OR SUCH THIRD PARTTY ARISING OUT OF OR IN ANY WAY RELATED TO THE USE OF SUCH CONFORMED CONSTRUCTION DOCUMENTS.

3.12 PROGRESS PAYMENTS

A. The submission and approval of progress updates and the reports calculating the value of work done for any given pay period for each activity based on the percentage complete for that activity less the amount previously paid for past percentages complete and percent of retainage shall be an integral part and basic element of the application upon which Progress Payments shall be made pursuant to the provisions of the General Conditions and/or Supplementary Conditions. The Contractor shall be entitled to progress payments only as determined from the current updated and approved Construction Schedule. Contractor shall submit (3) three original sets for the first and final applications for payment, with all original signatures of AIA form G702 and G703 (form G702/CMa is not acceptable). All other payment applications shall be submitted electronically as described in paragraph 3.01 Electronic Document Submittal Service.
   1. The initial and subsequent cost reports which are developed from the schedule of values shall include the following activity information:
      a. Activity number and activity description.
      b. Percentage of value of work in place against Total Value.
      c. Total cost of each activity.
      d. Value of work in place this period.
      e. Value of work in place to date.
      f. Value of uncompleted work.
      g. Value of stored material not in place.
      h. The cost report will be submitted as supporting documentation to the Contractor's application for payment. The application for payment shall be submitted as required by the Contract Documents.

i. Identify scopes of work (campuses/buildings) when applicable with a clear and concise heading.
j. Separate scopes of work with the appropriate heading per the 2016 MasterFormat standard.
k. “Description of Work” shall be identified by specification number and heading per 2016 MasterFormat standard while separating the “Labor” and “Material” costs throughout each line item in the scope of Work.
l. Include all associated contingencies and allowances expenditures.
   1) All contingency and allowance expenditures shall be listed sequentially and follow the same guidelines as noted below. “Description of Work” shall reflect the pricing exercise and identify contingency or allowance.
   2) Reference the example AIA Document G703 found at the end of this Section.
m. In the event the Work is completed without the use of 100% of the the associated funds in the contract, column "H" or "Balance to Finish" shall represent the total dollar amount being credited back to the owner via AIA G701

3.13 CONTRACTOR’S DAILY FIELD REPORT

A. Daily reports shall be used to record a chronological, day-to-day account of the work force, the respective activities performed, the weather conditions, and any specific events that take place on the Project.

B. The Daily Report shall not be used as a communication tool. Any situations requiring specific action shall be brought to the attention of the appropriate party by means of written correspondence, memoranda, or meeting minutes.

C. Photographs shall be used with the Daily Report to clarify or confirm statements and concerns.

D. The Contractor shall produce a Daily Report including the following information:
   1. Date.
   2. Weather, temperature, wind, and precipitation.
   3. Number of workers on site, listed by Subcontractor and Trade.
   4. Material and equipment deliveries.
   5. Construction quantities placed.
   6. General description of the Work accomplished.
   7. Specific problems encountered.
   8. Meetings held.
   9. List of visitors to the site and their companies.
   10. Construction photographs.

E. NOTE: Provide Owner with copies of signed Daily Report at weekly progress meetings.

3.14 REQUEST FOR INFORMATION

A. Contract document interpretations or clarifications shall be submitted by the Contractor to the Architect in the form of a written request for information (RFI).

B. RFIs shall be numbered sequentially and shall include only one question or related questions per RFI. If the Contractor’s question or request for interpretation is already clearly defined or discernible in the contract documents, the RFI may be returned unanswered and the Architect may be entitled to additional compensation (from the Contractor) for review time.

C. If the Contractor believes there may be additional contract cost or time incurred, it shall be stated in the RFI. If additional contract cost or time is required based on the RFI, the Architect will issue appropriate documentation for the proposed change. All changes in work shall be accomplished by approved change order only.

D. The Architect will respond to the RFI in a reasonable and timely manner, within approximately seven (7) business days from the date the RFI is received and stamped by the Architect's office. No extension of contract cost or time will be allowed due to a delayed RFI submittal or the response to an RFI.

3.15 DEVELOPMENT OF ADVERSE WEATHER DATA

A. Unless adverse weather data is defined elsewhere in the contract for construction, provide as follows;

B. Collection of Adverse Weather Data
   1. Weather data obtained from the National Oceanic and Atmospheric Administration (NOAA) shall form the baseline for estimating anticipated delays and project durations and determining the occurrence of unusually severe weather. Data shall be collected and compiled as follows:
      a. Contractor shall compile the number of days per month that the anticipated weather is expected to be adverse by analysis of NOAA. The last 5 years of consecutive data shall be used to establish the baseline of rain days per month associated with the project schedule duration. However, in the absence of 5 years of data, a shorter period may be used.
      b. The compiled data shall be submitted with the Contractors Construction Schedule for documenting future weather events.
   2. Adverse Weather is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents the Critical Path of construction activity exposed to weather conditions or access to the site:
      a. Precipitation (rain, snow, or ice) in excess of one-quarter inch (0.25") liquid measure.
      b. Temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified or accepted as standard industry practice.
      c. Sustained wind in excess of twenty-five (25) m.p.h.
      d. Contractor shall take into account that certain construction activities are more affected by adverse weather and seasonal conditions than other activities, and that "dry-out" or "mud" days are not eligible to be counted as Weather Delay Day until the standard baseline is exceeded. Hence, Contractor should allow for an appropriate number of additional days associated with the Standard Baseline days in which such applicable construction activities are expected to be prevented and suspended.
   3. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day and Critical Path construction activities were included in the day's schedule, including a weekend day or holiday if Contractor has scheduled construction activity that day.

C. Submission for Time Extension
   1. Although the contractor is required to document the occurrence and effect of adverse weather on the work, it does not relieve the Contractor/Architect of its responsibility to investigate and determine if an excusable delay has occurred.
   2. The schedule of anticipated adverse weather delays included in the contract is established in work days. Similarly, actual weather data should be collected and recorded on a work day basis. Monthly summaries should be maintained indicating actual adverse weather conditions and the impact on work activities.
   3. To determine if any particular month experienced unusually severe weather, the number of actual adverse delay days is compared to that as provided by the NOAA database. If the number of actual delay days is greater than that in the contract the contractor has experienced unusually severe weather.

4. THE DETERMINATION THAT UNUSUALLY SEVERE WEATHER OCCURRED DOES NOT AUTOMATICALLY MEAN THAT THE CONTRACTOR RECEIVES A TIME EXTENSION FOR THE DIFFERENCE OF DAYS BETWEEN THE ANTICIPATED AND ACTUAL ADVERSE WEATHER DELAY DAYS. Further analysis is necessary to determine if the unusually severe weather delayed work activities critical to contract completion. The contractor's progress schedule must be evaluated to make this determination. If it is found that unusually severe weather delayed the contract, a contract modification shall be issued pursuant to Gov. Code 2269
5. Claims for increase in the contract time shall set forth in writing the detail noting the circumstances that form the basis for the claim, the date upon which each cause of delay began to affect the progress of the work, the date upon which each cause of delay ceased to affect the progress of the work and the number of days increase in the contract time claimed as a consequence of each such cause of delay. The Contractor shall bear the entire economic risk of all weather delays and disruptions, and shall not be entitled to any increase in the Contract Price by reason of such delays or disruptions. Requests for an extension of time pursuant to this Subparagraph shall be submitted to the Architect in writing not later than the fifteenth (15th) day of the month following the month during which the delays or disruptions occurred, and shall include documentation demonstrating the nature and duration of the delays or disruptions. Where appropriate, a revised construction schedule indicating all the activities affected by the circumstances shall be included with the documentation.

END OF SECTION

CSP# 2026-08

Huckabee

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ELECTRONIC DOCUMENT RELEASE FORM

Date	

Transmitting Party	Huckabee
Address	
Phone	888.801.6673
Representative	

Receiving Party	
Address	
Phone	
Representative	

Project Name	
Project Number	

This Agreement is made in reference to the electronic drawing plan files for {Recipient} with {Receiving Firm.}

At your request, Huckabee will provide electronic files for your convenience and use in the preparation services performed related to the {Project Name}, subject to the following terms and conditions:

Data contained on these electronic files is part of Huckabee's instruments of service and is confidential and shall not be used by you or anyone else receiving this data through or from you for any purposes other than as a convenience in the preparation of drawings related to your scope of work. These electronic files are not contract documents or accurate record drawings, and significant difference may exist between these electronic files and the actual physical conditions of the facility and/or property.

You agree to assume all liability and risks associated therewith any use of these electronic files in the preparation of contract documents for the new project scope. With the use of these electronic files you agree to the fullest extent permitted by law to hold harmless and indemnify Huckabee and its consultants from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees, arising there from or in connection therewith. Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by Huckabee, and Huckabee makes no warranties, either expressed or implied for any particular purpose.

Copyrights are a form of intellectual property protection provided by federal law. Huckabee expressly retains ownership of all reports, drawings, plans, specifications, electronic files (including CAD/Revit/BIM models and files), field data, notes and other documents and instruments prepared by Huckabee and/or our Consultant(s) as instruments of service. Huckabee and applicable Consultants shall retain all common law, statutory and other reserved rights, including, without limitation, all copyrights thereto.

We do not mark all documents or digital files with copyright and we are not required to. You are hereby notified that our work (including digital) is protected by copyright, inherently identifying Huckabee as copyright owner and represented by publication date occurrence. This notice clarifies our work shall not be infringed upon by proper notice, disallowing any defendant to claim “innocent infringement.”

File Type:

- ☐ Construction
- ☐ Clash Detection
- ☐ Timeline Simulation
- ☐ Logistics Planning
- ☐ Quantity Extraction / Cost Estimating
- ☐ Shop Drawings
- ☐ Bidding
- ☐ Other

File Format:

- ☐ Revit (.rvt) File Name
- ☐ Navisworks (.nwc/.nwd/.nwf) File Name
- ☐ AutoCAD (.dwg) File Name File Name
- ☐ IFC (enter format type) File Name
- ☐ Design Review (.dwf) File Name
- ☐ Other

Accepted:

_____

Signature and Printed Name of Transmitting Party DATE

_____

Signature and Printed Name of Receiving Party DATE

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 1000 - Summary of Work.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016.

1.04 SUBMITTALS

A. Within 14 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations.

B. If preliminary schedule requires revision after review, submit revised schedule within 7 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

G. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements

H. Approval by the Owner and Owner's Representatives of the Contractor's Construction Schedule is advisory only and shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every Contract-required Milestone and Completion date. Omissions and errors in the approved Construction Schedule shall not excuse performance, which is not in compliance with the Contract. Approval by the Owner and Owner's Representatives in no way makes the Owner or Owner's Representatives an insurer of the Construction Schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of Owner or Owner's Representatives approval of or acquiescence to the Construction Schedule.

I. It is to be expressly understood and agreed by the Contractor that the schedule is an estimate to be revised from time to time as progress proceeds, and that the Owner does not guarantee that Contractor can start work activities on the early or late start dates or complete work activities on the early finish or late finish date shown in the schedule, or as same may be updated or revised; nor does the Owner or Owner's Representative guarantee that Contractor can proceed at all times in the sequence established by said schedule. If Contractor's schedule indicates that Owner or a separate contractor is to perform an activity by a specific date, or within a certain duration, Owner or any separate contractor under contract with Owner shall not be bound to said date or duration unless Owner expressly and specifically agrees, in writing, to same; the Owner's and / or the Owner's Representative's overall review and approval or acceptance of the schedule does not constitute an agreement to specific dates, duration or sequences for activities of the Owner or any separate contractor.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with three years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: three years minimum experience in using and monitoring CPM schedules on comparable projects.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Width required.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Critical Path Method (CPM) to show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of phases, separate stages or proposed occupancies and other logically grouped activities.

D. Provide sub-schedules for each stage of Work identified in Section 01 1000 - Summary.

E. Include contract milestone dates and completion dates as specified in the contract.

F. Provide sub-schedules to define critical portions of the entire schedule.

G. Include conferences and meetings in schedule.

H. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

I. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

J. Indicate delivery dates for owner-furnished products and Owner furniture or equipment scheduled for salvage and/or relocation in project.

K. Indicate testing of materials.

L. Indicate activity periods for punch list.

M. Indicate the work to be performed during the facility's scheduled holidays, weekends, or summer recess periods.

N. Coordinate content with schedule of values specified in Section 01 3000.

O. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

C. The schedule diagram shall be a time-scaled drawing.

D. The Construction Schedule Detailed Reports, initial submittal and subsequent updates or revisions, shall indicate each of the following:
   1. Description of activity including activity number/numbers.
   2. Estimated duration time or remaining duration for each activity.
   3. Early start date for each activity.
   4. Late start date for each activity.
   5. Early finish date for each activity.
   6. Late finish date for each activity.
   7. Float available for each path of activities containing float.
   8. Actual start date for each activity begun.
   9. Actual finish date for each activity completed.
   10. Identification of all critical path activities in the mathematical analysis.
   11. The critical path for the Project, with said path of activities being clearly and easily recognizable on the time-scaled graphic diagram, and the relationship between all non-critical activities and activities on the critical path shall be clearly shown on the graphic diagram.
   12. The dollar value of each activity in relation to the schedule of values. This may be shown on a separate cost report.
   13. The responsibility code for the Contractor or Subcontractor performing each activity or portion thereof.
   14. The percentage complete of each activity in progress or complete.

3.04 SCHEDULE OF OFF-SITE ACTIVITIES

A. The Contractor shall include in his Construction Schedule all procurement related activities which lead to the delivery of materials to the site in a timely manner. Upon written approval by the Project Manager, these activities may be submitted as a separate Off-Site Activities Schedule, properly correlated to the Construction Schedule. The schedule of off-site activities shall include, but is not limited to, the following:
   1. Dates for submittals, ordering, manufacturing or fabricating, and delivery of equipment and materials. Long lead items requiring more than one month between ordering and delivery to site shall be clearly noted;
   2. All significant activities to be performed by the Contractor during the fabrication and erection/installation in a Contractor's plant or on a job site, including materials/equipment purchasing, delivery; and
   3. Contractor's drawings and submittals to be prepared and submitted to the architect.

B. The Contractor shall be solely responsible for expediting the delivery of all material to be furnished by him so that the construction progress shall be maintained according to the current schedule for the Work.

C. The Owner's Representatives shall be advised, in writing, by the Contractor whenever it is anticipated by the Contractor that the delivery date of any material and/or equipment furnished by the Contractor for installation will be later than the delivery date shown on the schedule, subject to schedule updates.

D. Submittals, equipment orders and similar items are to be treated as schedule activities, and shall be given appropriate activity numbers.

3.05 FLOAT TIME

A. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of an activity or a chain of activities on the Construction Schedule. Float or slack time is not for the exclusive use or benefit of either the Contractor or the Owner. Contractor's work' shall proceed according to early start dates, and the Owner's Representatives shall have the right to reserve and apportion float time according to the needs of the Project. The Contractor acknowledges and agrees that actual delays, affecting paths of activities containing float time, will not have any affect upon Contract completion times, providing that the actual delay does not exceed the float time associated with those activities.

B. Extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustment for the activity or activities affected by any condition or event which entitles the Contractor to a time extension exceed the total float or slack along the path of activities affected at the time of Notice to Proceed of a Change Order or the commencement of any delay or condition for which an adjustment is warranted under the Contract Document.

3.06 SCHEDULE UPDATES AND REPORTS

A. Every month, in conjunction with the monthly application for payment, the Contractor shall submit an updated graphic diagram and an updated detailed schedule report from the Construction Schedule and updated Record Documents. Contractors Application for Payment shall not be approved for payment unless schedule is attached and Record Documents are current. The schedule shall be updated to show actual progress and the effect of delays and other events. The actual start and finish dates shall be included in the detailed report, as well as the actual dates of the Milestone events.

B. The content of the updated Construction Schedule shall be equal to that noted in Section 1.02 Construction Schedule.

C. The updated Construction Schedule submitted by Contractor shall not show a completion date later than the Contract Completion Date, subject to any time extensions approved by Owner.

3.07 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 7 days.

3.08 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effectincluding the effects of changes on schedules of separate contractors.

3.09 RECOVERY SCHEDULE

A. Should the Contractor's Construction Schedule indicate that the progress of the work is behind schedule to the extent that any of the mandatory specific or milestone dates or completion dates are in jeopardy the Contractor shall be required to, at no extra cost to the Owner, prepare and submit to the Owner's Representatives within 72 hours, a Recovery Plan, in a form and detail appropriate to the need and explain and display how he intends to reschedule those activities to regain compliance with the Construction Schedule.

3.10 SCHEDULE REVISIONS

A. Should the Contractor, after approval of the initial Construction Schedule, desire to change his plan in construction, he shall submit his required revisions to the Owner's Representatives along with a written statement of the revisions including a description of the logic for rescheduling the work, methods of maintaining adherence to intermediate Milestones and Specific Dates and the reasons for the revisions. The Contractor shall revise his schedule to include the effect of changes, acts of God, and other conditions or events, which have affected the Schedule. If the requested changes are acceptable to the Owner and Owner's Representatives, the changes will be incorporated into the Construction Schedule in the next reporting period.

B. When the Owner orders changes by change Order which have the potential to impact the Contract Milestones or Specific Dates stipulated in the Supplemental Conditions, a Schedule will be prepared by the Contractor and provided to the Owner's Representatives for concurrence or revision. After the proposed schedule revision has been mutually agreed upon, it will be incorporated into the Construction Schedule. Change Order logic will affect only those activities and performance data directly concerned. Adjustments in Scheduled intermediate Completion Dates or for the Contract as a whole will be considered only to the extent that there is insufficient remaining float to absorb these changes.

C. Any change to the approved Construction Schedule must be approved, in writing, by the Owner and Contractor.

D. Neither the updating or revision of Contractor's Construction Schedule nor the submission, updating, change or revision of any report or schedule submitted to Owner's Representatives by Contractor under this Section nor Owner's review or non-objection of any such report or schedule shall have the effect of amending or modifying, in any way, the Contract Time, any Contract Completion Date, or Contract Milestone Dates or of modifying or limiting in any way Contractor's obligations under this Contract.

3.11 REQUESTED TIME ADJUSTMENT SCHEDULE

A. The updated Construction Schedule submitted by Contractor shall not show a completion date later then the Contract Time, subject to any time extensions approved by Owner:

1. Provided, however, that if Contractor believes he is entitled to an extension of the Contract Time under the Contract Documents, Contractor shall submit to Owner's Representatives, with each progress payment update, a separate schedule analysis (entitled "Requested Time Adjustment Schedule") indicating suggested adjustments in the Contract Time which should, in the opinion of Contractor, be made in accordance with the Contract Documents by time extension, due to changes, delays or conditions occurring during the past month or previously, or which are expected or contemplated by Contractor (whether such conditions are excusable under the Contract or are alleged to be due to Contractor or Owner fault); this separate schedule, if submitted, shall be time-scaled utilizing a computer generated and computer-drawn Schedule analysis schedule, unless otherwise approved by the Owner's Representative and shall be accompanied or preceded by a formal time extension request as required by the Contract and a detailed narrative justifying the time extension requested.

B. The time extension request shall include schedule forecasts that predict the actual Project Completion Date, and any separable portions thereof specified by Owner plus a forecast of the actual achievement of any milestones listed in the Owner-Contractor Agreement.

C. To the extent any time extension requests are ending at the time of any update in the Construction Schedule, the “Requested Time Adjustment Schedule” shall also be updated each month, to reflect any adjustments made by Contractor in the logic, sequence or duration of any activities in the Construction Schedule, or any time extensions previously granted by Owner, and to reflect actual or expected progress, in order that the “Requested Time Adjustment Schedule” shall clearly and accurately reflect Contractor’s Actual intention and proposed time adjustments as of the latest update.

D. Neither the Owner, the Project Manager or the Architect shall have any obligation to consider any time extension request unless the requirements of the Contract Documents, and specifically, but not limited to these requirements, are complied with; and Owner shall not be responsible or liable to Contractor for any constructive acceleration due to failure of Owner to grant time extensions under the Contract Documents should Contractor fail to substantially comply with the submission requirements and the justification requirements of this Contract for time extension requested. Contractor’s failure to perform in accordance with the Construction Schedule shall not be excused, nor be chargeable to Owner, because Contractor has submitted time extension requests or the "Requested Time Adjustment Schedule”.

3.12 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 01 4516 - Contractor Quality Control. Testing and Inspection services.

C. Section 01 4533 - Code-Required Quality Control.

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract. Contractor, and its Delegated Design Professional, shall be responsible for coordinating with the Design-Related Professional Design Services with the Architect.

B. Base design on performance and/or design criteria indicated in individual specification sections. Design shall be coordinated with and or compatible with all other applicable elements, materials, products, and or components in the Contract Documents.

1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.
2. Submit a Request for Information for any issue necessary to fully and properly coordinate and complete the design in accordance with the Contract Documents.

C. Contractor's Delegated Design Professional shall be responsible for code compliance of all aspects of the Delegated Design whether or not all codes and or their specific code requirements are specifically identified and or called out in the Contract Documents.

D. Contractor shall coordinate with, and obtain written approval from, the Architect for any Delegated Design results that modify the original intent of the Contract Documents regarding occupancy, aesthetics, function, performance, or any design feature.

E. Contractor shall promptly provide written notification to the Architect when Contractor becomes aware of any errors and or omissions regarding the Contractor's professional design services.

F. 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 the Contractor or the Delegated Design Professional. 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.

G. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures, including but not limited to submittal review responsibilities.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Texas.
   1. The General Contractor or Construction Manager shall comply with the Texas Professional Services Procurement Act when selecting an Engineer for Delegated Design Services.

1.07 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain, review and comply with copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the Owner, Architect, Contractor or any of their respective subconsultants or subcontractors shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in specification Section 01 4516 - Contractor's Quality Control and Section 01 4533 - Code-Required Quality Control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups for each form of construction and finish required, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Integrated Exterior Mock-ups: Construct integrated exterior mock-up. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. See Section 04 2000-Unit Masonry for additional mock-up requirements for field sample panels and integrated envelope and wall assembly.

C. Integrated Room Mock-ups: Construct integrated room mock-ups for one room type of each classroom, office, and restroom. Mock-ups shall include the scope per contract documents along with Owner furnished equipment.

D. Obtain Owner and Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Owner and Architect's approval is issued.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate beyond the maximum overall allowable tolerance level.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.
   2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect and Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.

B. Section Includes, but is not limited to:
   1. Permits and fees.
   2. Code and regulatory compliance for the associated Work.

C. 2012 TAS - Texas Accessibility Standards; 2012.

D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements.

1.03 PERMITS AND FEES

A. The Contractor will pay for all City and/or State Building Permits, Impact Fees, and other Building Fees related to the project. The Contractor and Subcontractors will be responsible for obtaining all required trade permits or license fees.

B. Once General Contractor is in possession of the final construction permits (building permits), Contractor shall be responsible for submitting to the AHJ, approved request for pricing (RFP), change orders, or other documents that contain significant changes to the contract until construction is complete. Contractor shall pay for permits or fees associated with any required changes.

1.04 BUILDING CODES

A. Building Code Compliance: Reference drawings for year editions used in document design.
   1. Building Code – International Building Code
   2. Plumbing Code – International Plumbing Code
   3. Mechanical Code – International Mechanical Code
   4. Electrical Code – National Electrical Code
   5. Life Safety Code – NFPA 101

B. Energy Code Compliance
   1. Energy Code – International Energy Code.
   2. Contractor shall provide, at the jobsite office, one copy of the completed energy code review.
   3. Contractor shall notify energy code plan review company for all required energy inspections.
      a. Milestones for inspections shall be as follows:
         1) Envelope: Building cladding is substantially complete, windows are delivered and installed, roof insulation has been installed and if possible is visible, interior finish of exterior walls has not been installed so any exterior wall insulation is visible
         2) ME rough-in: Mechanical ductwork is substantially installed, equipment is set, lighting fixtures are installed, ceiling is open (equivalent to an above-ceiling inspection)
         3) Final: Final verification of all mechanical, lighting, controls, envelope as installed and commissioned. Envelope penetrations (e.g. doors, windows) are closed, roof is complete.
      b. Contact Information:

1) Building Solutions
9401 Lyndon B. Johnson Freeway, Suite 410
Dallas, Texas, 75243
Phone: 214.221.9145

C. Accessibility Compliance
1. Accessibility requirements are from the 2010 ADA Standards for Accessible Design, and the 2012 TAS Texas Accessibility Standards of the Architectural Barriers Act.
2. The information contained in this section is provided to identify the modifications provided for users who are not served by adult standards. It shall be the Contractors responsibility to be familiar with the standards and to apply the standards to all aspects of the project. Any apparent conflict between current standards and the drawings shall be brought to the architect's attention for clarification. The information in the drawings does not release the contractor from full compliance with the latest TAS requirements.
3. Contractor shall provide, at the jobsite office, one copy of the 2012 Texas Accessibility Standard (TAS) regulations as prepared by the Texas Department of Licensing and Regulation, concerning handicap accessibility. The Contractor shall conform to the regulations as set forth in the TAS. Copies can be obtained at Texas Department of Licensing and Regulation, P.O. Box 12157, Austin, TX; 512-539-5669 / Fax 512-539-5690; www.license.state.tx.us. Copies may be downloaded from http://www.license.state.tx.us/ab/abtas.htm.
4. Federal Register:
a. Vol. 56, No. 144, July 26, 1991, Rules and Regulations; Appendix A to part 36 – Standards for Accessible Design.
b. 5 U.S.C. 552(a) and 1 C.F.R. part 51, Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Building Elements Designed for Children's Use.
5. Texas Accessibility Standards
a. The Elimination of Architectural Barriers Texas Government Code, Chapter 469, effective March 15, 2012.

1.05 ACCESSIBILITY REQUIREMENTS

A. General
1. All general TAS standards apply and staff-use areas and spaces for the use of students above the age of 12 shall be designed for adult users. In facilities for younger students, adult-use spaces will commonly be identified by their name (MEN, WOMEN, STAFF TLT, etc). Juvenile-use spaces will be likewise identified (BOYS, GIRLS, STU TLT, etc.).
2. Besides the transition to adult dimensions for students above the age of 12, some requirements vary additionally, depending on age. Refer to the tables enclosed for the varying heights and spacing required.
3. Age/Grade ranges are interpreted as follows:
a. Ages 3 years and 4 years / Pre-Kindergarten
b. Ages 5 years thru 8 years / Kindergarten thru 3rd Grade
c. Ages 9 years thru 12 years / 4th Grade thru 7th Grade
d. Over 12 years / 8th Grade thru Adult

B. Dimensional Tolerances
1. Contractor is reminded that while the TAS guidelines allow for "construction and manufacturing tolerances" there is no "definition" of what that tolerance is, therefore, where TAS gives a single absolute dimension, every effort should be made to equal that dimension. Where TAS provides a dimensional range, or a minimum or a maximum, there is NO construction tolerance. Any dimension less than the minimum or more than the maximum will be rejected upon inspection and subject to correction.

1.06 QUALITY ASSURANCE

A. Contractor's Designer Qualifications: Refer to Section - 01 4000 - Quality Requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Contractor shall note that no regulatory agency designates products with a formal “ADA Approved” designation. Contractor shall be responsible for ensuring all products are reviewed for accessibility compliance.

PART 3 EXECUTION

3.01 REPAIR

A. Non-Compliant Work
   1. The Contractor shall be responsible for removing and correcting all work that is found to be in non-compliance.
   2. The Contractor shall perform all work at no expense to the Owner.
   3. The Contractor shall be responsible to perform all repairs regardless of the date at which the non-compliant items are found.

B. The work shall be performed such that there will be no disruption to the Owner schedule.

END OF SECTION

SECTION 01 4339
MOCK-UP WALL CONSTRUCTION

PART 1 – GENERAL

1.01 DESCRIPTION

A An Envelope Pre-construction meeting shall be held with all of the subcontractors responsible for erecting the envelope related materials.
1. Attendees shall include (but are not limited to): General Contractor, framing and sheathing subcontractor, masonry subcontractor, weather barrier subcontractor, storefront and glazing subcontractor, roofing and sheet metal subcontractors, ACM and metal panel subcontractor, mechanical and electrical subcontractors, and any other trade that will install products in the exterior building envelope, or penetrate through the exterior envelope.

B. Work includes: Constructing mock-up, including all reviewed submittals required by the Contract Documents, to establish compliance with the design intent as well as the specified requirements to provide a complete and watertight facility.

C. Providing a photo manifest of as-built conditions as the mock-up is being constructed. Photos shall be kept at the job site during construction for reference.

D. Mock-up fabrication must be completed and reviewed and approved by the Owner and Architect prior to starting installation of building envelope construction.

1.02 RELATED REQUIREMENTS

A. Individual sections of these specifications for each material indicated for use in the mock-up wall construction. Refer in particular to Section 07 25 50 – Weather Barrier Complete Envelope System.

1.03 SUBMITTALS

A. Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, etc. as required for items to be installed in the mock-up wall construction.

C. All submittals for materials required in the mock-up walls shall be approved prior to beginning work on the mock-up wall construction.

1.04 PURPOSE

A. The mock-up wall panels are to be constructed as indicated on the drawings, including toothed masonry construction to allow exposed flashings, etc. Construction of the mock-up walls are intended to:
1. Provide an acceptable quality standard for the completed work.

2. Identify color and finish selections of the various materials used, as well as the acceptable range of color and variations within those materials.
3. Establish the required coordination between trades and the sequence of necessary installations to provide a complete and watertight building envelope.

1.05 QUALITY ASSURANCE

A. Coordination of product submittals and construction installation:
1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
2. Verify that each item being submitted is in conformance in all respects with the specified requirements.
3. By affixing the Contractor's signature to each submittal for the mock-up, the contractor certifies that this coordination has been performed.
4. Contractor shall construct the site built mock-up with the same manner of specified construction as the new construction.
5. Contractor shall construct the site built mock-up with the same workmanship and quality as being implemented on the new construction.
6. All material to be installed shall be reviewed by architect and consultants for conformance.

PART 2 – PRODUCTS

2.01 MOCK-UP REQUIREMENTS

A. Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mock-up wall construction shall be coordinated by the General Contractor and constructed by the subcontractor responsible for the actual construction work. All conditions and materials to be used on the job shall be included in the mock-up. Build mock-ups to comply with the listed requirements, using materials indicated for the completed Work.

B. Contractor shall start the construction of the mock-up based on, but not limited to, the following list:
1. Foundation if subgrade is present
2. Waterproofing membrane
3. Damproofing material
4. Flexible Through-Wall Flashing Membrane
5. Metal Through-Wall Flashing
6. Preformed Flashing Pieces
7. Face Brick with Mortar and Weeps
8. CMU with mortar and weeps
9. Wall Ties
10. Weather Barrier
11. Portland Cement Plaster
12. Metal Panels, Wall and Soffit
13. Metal Roof Panels
14. Low Slope Roof System
15. Weeps

16. Window Unit
17. Louver Unit
18. ICF Wall Systems with weather barriers

C. Samples and Manufacturer's Submittals: Submit prior to delivery or installation.
1. Samples of all building system components including all specified accessories.
2. Submit samples of proposed warranties complete with any addenda necessary to meet the warranty requirements as specified.
3. Submit latest edition of manufacturer's specifications and installation procedures. Submit only those items applicable to this project.
4. A written statement from the materials manufacturer approving the installer, specifications and drawings as described and/or shown for this project and stating the intent to guarantee the completed project.
5. Follow submitted shop drawings, product data of all sheet metal.

D. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large enough to show all pertinent aspects of the item and its method of connection to the work.

E. Shop Drawings and Product Data: Provide manufacturer's approved details of all conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.
1. Manufacturer's Details: All termination details and other details normally required by the manufacturer's Technical Specifications, including both standard details and special details, shall be furnished by the Contractor and shall be approved in writing by the manufacturer, the company project manager, and the Owner's representative prior to final installation.

F. Provide manufacturer's approved details, of all perimeter conditions, project conditions, and any additional special job conditions which require details other than indicated in the drawings.

2.02 MANUFACTURER'S LITERATURE

A. Work provided on the mock-up shall follow all of the submitted literature from manufacturers.

B. Manufacturer’s literature shall be the minimum for basis of design and shall be in conjunction with construction documents. All manufacturers' warranties shall remain in effect as specified.

2.03 SAMPLES

A. Provide sample or samples identical to the precise article proposed to be provided.

2.04 COLORS AND PATTERNS

A. Unless the precise color and pattern are specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect/Project Manager for selection in advance of the Envelope Pre-Construction meeting.

B. Contractor shall coordinate with Architect for exact layout or design of patterns and textures and how they are to be installed on the mock-up.

PART 3 – EXECUTION

3.01 ENVELOPE PRE-CONSTRUCTION MEETING

A. Convene a minimum of one week prior to initiation of the mock-up wall construction.

B. Verify that all required submittals have been approved and that color/finish selections have been made.

C. Establish coordination between trades and establish sequencing of material installations to ensure a complete and watertight assembly.

D. Distribute meeting minutes and agreed upon sequencing to all subcontractors.

E. Construct mock-up walls in accordance with the established procedures and installation sequencing.

3.02 INSTALLATION OF MATERIALS

A. Contractor shall install all materials on mock-up in same manner required for the main structure. Refer to specification sections for basis of design of all material being installed on this mock-up.

B. During installation, Contractor shall maintain a photo manifest of mock-up construction for Architect and Owner to review.

C. Quality of installation is of utmost importance and shall be monitored for completeness and conformance with the design intent and manufacturer's installation recommendations.

D. Once mock-up is complete, it shall be reviewed by the Architect and Owner’s Representative for conformance to construction documents.

E. Contractor shall install material in same sequencing as required by industry standards.

3.03 INSTALLATION OF WINDOWS AND ASSOCIATED FLASHING

A. Installer shall coordinate the installation of the window with associated trades to maintain proper compatibility of material.

B. Installation shall be in accordance with referencing specifications.

C. Install all perimeters flashing as detailed to create a sealed and watertight condition which includes the installation of the intermediate bead of sealant and backer rod prior to the installation of the membrane.

D. Once window and flashing has been installed, Contractor shall notify Architect, Owner and Consultants for review for conformance and shall provide a water test of all wall flashing. Contractor shall notify Architect, Owner and Consultants to observe the testing. All tests shall be in accordance with referencing specifications.

3.04 INSTALLATION OF FLASHING AT THROUGH-WALL LOCATION

A. Installer shall coordinate the installation of the wall flashing with associated trades to maintain proper compatibility of material.

B. Installation shall be in accordance with referencing specifications.

C. Once flashing has been installed, Contractor shall notify Architect, Owner and Consultants for review for conformance and shall provide a water test of all wall flashing. Contractor shall notify Architect, Owner and Consultants to observe the testing. All tests shall be in accordance with referencing specifications.

D. Maintain a photo manifest of all installed locations through out the construction.

3.05 CONSTRUCTION SCHEDULE

A. Once installation sequences have been determined and mock-up wall construction has been approved, modify the Construction Schedule to reflect the established sequencing of material installations and testing requirements. Distribute revised schedule.

END OF SECTION

SECTION 01 4516
CONTRACTOR'S QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control of installation.

B. Testing and inspection services by one or more quality assurance laboratories to be employed by the Contractor (if these services are not provided by subcontractors or material suppliers). The purpose of quality assurance services are so that the Contractor can verify work is done properly during construction, before the Contractor requests that the Owner's Independent Quality Control Agency performs code-required special inspections, tests and structural observations. The Contractor's QA Laboratory testing and inspection services shall include, but not be limited to:

1. Testing, inspection, and certifications specified in sections of Project Manual other than Section 01 4533. This quality assurance testing shall be paid by the Contractor.
2. Earthwork borrow pit material verification
3. Concrete mix design verification
4. Masonry unit compressive strength verification
5. Structural Steel quality assurance recommended by AISC
6. HVAC Testing and Balancing
7. Indoor Air Quality Testing
8. Certification of No Asbestos Containing Materials

C. References and standards.

D. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 4000 - Quality Requirements

D. Section 01 4533 - Code Required Quality Control

E. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 QUALITY ASSURANCE (OF CONTRACTOR'S QUALITY ASSURANCE LABORATORY)

A. Contractor's QA Laboratory Qualifications and Procedures:

1. Meet "Recommended Requirements for Independent Laboratory Qualification," latest edition published by American Council of Independent Laboratories. Testing agencies shall meet the requirements of ASTM E 329, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction" and ASTM E 543, "Determining the Qualification of Nondestructive Testing Agencies."
2. The inspection and testing services of the testing agency shall be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having at least five years engineering experience in inspection and testing of construction materials.
3. Inspecting personnel monitoring concrete work shall be ACI certified inspectors.
4. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection. Include memorandum of remedies of deficiencies reported by this inspection.
5. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
6. Tests and inspections shall be conducted in accordance with specified requirements and if not specified, in accordance with applicable standards of the American Society for Testing and Materials and other recognized authorities as approved.
7. Primary inspectors 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 assistant inspectors shall be regularly monitored by the inspector, generally on a daily basis.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. See Section 01 4000 - Quality Requirements

3.02 GENERAL REQUIREMENTS FOR CONTRACTOR'S LABORATORY SERVICES

A. The Contractor shall perform various tests as required in the various specification sections for conference to the construction documents other than those in Section 01 4533. The Owner maintains the right to verify the test results with an independent testing lab.

B. Contractor's design testing and certification testing includes:
   1. Testing defined in this Specification Section.
   2. Testing when source of material is changed after initial tests have been performed.
   3. Other testing required by other Sections of the Specifications.

3.03 EARTHWORK

A. Earthwork: Identify suitable material at borrow material location, sampling soil material, and testing of soil material samples.

3.04 DRILLED PIERS

A. The Contractor shall provide all equipment, materials and labor required for the Test Pier Holes specified in Section 31 6329.

3.05 CONCRETE

A. 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 by an independent testing laboratory are required, the laboratory shall be selected by the Contractor, approved by the Architect, and paid by the Contractor.

3.06 MASONRY

A. Furnish laboratory testing from the manufacturer or a Contractor-hired laboratory that verifies the compressive strengths of masonry units comply with specifications.

B. Absorption Tests:
   1. Perform a field of test for water absorption on three representative clay units and at least once for each 5,000 square feet of wall before laying.
   2. The field test shall consist of drawing a one inch diameter circle with a wax pencil (the diameter of a quarter). Place thirty (30) drops of water from a medicine dropper in rapid succession with the circle. If all of the water is absorbed into the brick in less than 60 seconds, the units shall be deemed "to dry" and shall be prewetted.

3.07 STRUCTURAL STEEL

A. Provide current welder certifications for each welder to be employed.

B. Performing certified welding procedure qualification and re-qualification testing specified in Section 05 1200, 05 2100, 05 3100, 05 4000, 05 4400, 05 5000 and 13 3419 and as recommended by the American Welding Society.

C. Testing of materials when mill certificates are unavailable.

3.08 HVAC TESTING AND BALANCING

A. The Contractor shall provide complete testing and balancing services for all HVAC and control systems to be carried out by an independent certified testing and balancing (TAB) agency under a separate and direct contract with the General Contractor. Scope of testing and balancing services, Contractor obligations, etc. shall be in accordance with Testing, Balancing and Commissioning specification section.

3.09 INDOOR AIR QUALITY TESTING

A. The Contractor shall provide complete air quality testing services for the project to be carried out by an independent certified agency under a separate and direct contract with the General Contractor. Scope of testing services, Contractor obligations, etc. shall be in accordance with Section 01 5719 – Indoor Air Quality Requirements.

3.10 CERTIFICATION OF NO ASBESTOS CONTAINING MATERIAL

A. The Contractor shall provide the Architect a written certification of the following;
   1. Hazardous material-free construction – certify that no asbestos containing material was used and/or incorporated into the project during construction.

2. The statement shall be as follows:
   a. The undersigned, pursuant to the General and Supplementary Conditions of the Contract for Construction, hereby certifies that to the best of his/her knowledge, information and belief, the materials incorporated into the project and as used during the construction process are free of any type of asbestos material, lead, polychlorinated biphenyl (PCB) or other materials identified by governmental agencies as being hazardous.

3.11 MANUFACTURERS' FIELD SERVICES

A. See Section 01 4000 - Quality Requirements

3.12 DEFECT ASSESSMENT:

A. See Section 01 4000 - Quality Requirements

END OF SECTION

SECTION 01 4533
CODE-REQUIRED QUALITY CONTROL

PART 1 GENERAL

1.01 IMPORTANT NOTE FOR ALL PLAN REVIEWERS (AHJ) TO READ BEFORE ISSUING A BUILDING PERMIT!

A. This Section (Specification Section 01 4533) is the "Statement of Special Inspections, Testing, Structural Observations and Commissioning" for this project and is hereby submitted to the building official for review and approval. This statement has been prepared collaboratively by the Architect and appropriate Design Professionals such that the registered design professional responsible for the design of each portion of the work considered the requirements of Chapter 17 of the International Building Code (IBC), considered the Commissioning requirements of the International Energy Conservation Code, considered the nature of the work, and then customized this statement specifically for this project based on their professional opinion of what they recommend for the code-required quality control plan. In some instances, the special inspections, testing and/or structural observation required by this statement are significantly less than the special inspections, testing and/or structural observations that would be required by the IBC without Exception #1 in IBC Section 1704.2 which states special inspections, tests, and/or structural observations are not required for construction as warranted by conditions in the jurisdiction as approved by the building official. This customized quality control plan also includes some variations from procedures required by IBC Chapter 17, such as submitting certain items to Registered Design Professionals in lieu of the AHJ; these variations are based on procedures that AHJ's have indicated are preferred and also the experience of the Registered Design Professionals which indicates that this quality control plan (including these procedural variations) will meet or exceed the local standard of care. It is our understanding that the AHJ has the authority to allow these procedural variations on code-required quality control because the AHJ has the authority to waive the entire quality control plan under Exception #1 in IBC Section 1704.2. According to IBC Section 105.3.1, "If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable." Therefore, if a building permit is issued without written notification that this statement or a portion thereof is rejected, it will be understood that this Statement of Special Inspections, Testing, Structural Observations and Commissioning is acceptable in the opinion of the building official, who has the authority to render interpretations of the code according to IBC Section 104. For clarification, this Statement includes the information required by IBC Section 1704.5 to be submitted to the AHJ before commencement of structural observations.

B. Chapter 17 of the International Building Code requires that the AHJ approve Special Inspection and Testing Agency (SITA) staff qualifications and requires that discrepancies identified during construction be resolved in order to comply with the building code. Based on Huckabee's experience with numerous AHJ's, it is understood that, instead of the AHJ directly reviewing these qualifications and resolutions, it is acceptable to the AHJ for Registered Design Professionals to determine whether or not SITA staff qualifications are acceptable and determine what resolutions to discrepancies identified during construction comply with the building code, without soliciting the opinion of the AHJ. And, for clarification, some discrepancies that occur during construction often include scenarios in which the specified scope for a quality control agency was not performed due to the Owner not hiring an agency to do some portion of the scope, inaction by the Contractor, inaction by the hired quality control agency or a miscommunication between parties. Therefore, it shall be considered acceptable for the Registered Design Professionals for each respective design discipline to be considered the sole determinant of acceptable quality control agency qualifications and resolutions of discrepancies and not report these details to the AHJ, if a building permit is issued without written notification that this understanding is incorrect.

1.02 OWNER-PREPARED DOCUMENTS

A. Sections 01 1400 and 01 4533 require that the Owner participate in the preparation of certain documents (e.g. Owner Agreement with the SITA) before critical construction schedule milestones. Proposers shall assume for proposal purposes that the Owner will provide these documents or provide all necessary participation of these documents without causing a delay to the construction schedule. However, the Contractor shall notify the Owner in writing 45 days before such a document is necessary to avoid a delay, notifying the Owner in writing of the deadline necessary to avoid a delay.

1.03 REQUIREMENTS FOR QUALITY CONTROL

A. Requirements for Quality Control:
   1. Special inspections and testing services shall be provided by an agency to be selected and employed by the Owner, which is referred to herein as the Special Inspection and Testing Agency (SITA). The SITA may subcontract other firms to provide quality control services on behalf of the SITA as necessary; however, the SITA shall be responsible for providing directly or indirectly all of the SITA responsibilities defined in Section 01 4533.
   2. Commissioning services shall be performed by the Commissioning Agent (CxA) as specified in Division 01 and Divisions 22-26.
   3. As a general part of the Code-Required quality control plan, Design Professionals shall be notified at appropriate times and allowed to make site visits and visual observations for general conformance with the contract documents.
   4. It shall not be required to notify and obtain approval from the AHJ if alternative arrangements are made in hiring firm(s) to provide quality assurance services (e.g. Owner hiring multiple firms, Architect acting as the Owner's Agent and hiring the SITA, Owner hiring the Structural Observer, etc…)
   5. Each type of quality control service shall be considered separate from every other type of quality control service. The services by one quality control firm do not relieve the responsibility of the other quality control firm to provide their quality control services.

1.04 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 01 1400 - Work Restrictions: Work restrictions related to quality assurance.

C. Section 01 3000 - Administrative Requirements: Submittal procedures.

D. Section 01 4000 - Quality Requirements.

1.05 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): The agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located. Where the term "building official" is used, it shall refer to the AHJ

B. Code or Building Code: 2015 Edition of the International Building Code and documents referenced by that document.

C. Commissioning Agent (CxA): The agent specified to perform the Commissioning specified in Division 01 and Divisions 22-26.

D. Design Professionals: For the purposes of Section 01 4533, the term “Design Professionals” shall refer to every Design Professional responsible for the design, or making recommendations regarding the design, of any portion of the project, including but not limited to the Geotechnical Engineer, professionals that sealed drawings on the Contract Documents, as well as any professionals hired by the Contractor. (Examples on some projects may be the Geotechnical Engineer, Architect, Civil Engineer, Structural Engineer, Mechanical Engineer, Electrical Engineer, Contractor’s Cold Formed Metal Framing Engineer, Contractor’s Pre-Manufactured Canopy Engineer, Contractor’s Pre-Engineered Metal Building Engineer, Contractor’s Precast Concrete Engineer, etc…)

E. Special Inspection and Testing Agency (SITA): The agencies responsible for providing all required special inspections and testing defined by Section 01 4533.
   1. Where used in the contract documents, the following terms (if used) shall also refer to the Special Inspection and Testing Agency (SITA):
      a. "Special Inspection Agency"
      b. "Construction Materials Engineering Firm"
      c. "Construction Materials Testing Firm"
      d. "Owner's Testing Laboratory"
      e. "Independent Testing Laboratory"

F. Special Inspections and Tests: The Special Inspections and Tests for this project are the inspections and tests required by Section 01 4533. These special inspections and tests are independent of any inspections and tests conducted directly by Humble ISD or Contractor.

G. Quality control observations: For the purposes of Section 01 4533, the term “quality control observations” shall refer to the observations by the following quality control personnel:
   1. CxA
   2. Design Professionals

H. Quality control observers: For the purposes of Section 01 4533, the term “quality control observers” shall refer to the personnel acting on behalf of the firms providing quality control observations.

I. Quality control personnel: For the purposes of Section 01 4533, the term “quality control personnel” shall refer to the personnel acting on behalf of the following as they perform quality control services associated with Section 01 4533:
   1. SITA
   2. CxA
   3. Design Professionals

J. Quality control services: For the purposes of Section 01 4533, the term “quality control services” shall refer to the services required by Section 01 4533 to be performed by the quality control personnel.

1.06 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary ; 2011.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement ; 2015.

C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field ; 2012.

D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete ; 2010.

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel ; 2008.

F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel ; 2011.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories ; 2010.

H. IAS AC291 - Accreditation Criteria for Special Inspection Agencies ; 2012.

I. AASHTO R18 - Accreditation for Materials Testing Laboratories

1.07 APPROVAL OF SITA QUALIFICATIONS AND SCOPE

A. SITA Qualifications: Before performing any SITA services on this project, the SITA shall submit to the Architect a statement for approval by the Architect indicating that the SITA firm and SITA Staff that will be assigned to this project will meet the following qualifications. The SITA shall indicate the years of experience performing similar work if a listed certification is not held by any proposed personnel (e.g. “We will only assign staff to this project that meets the listed certifications in Section 01 4533 with the exception that our masonry inspection and testing personnel have at least 10 years of experience performing masonry inspection and testing on similar projects but do not have a TMS Certification”):

1. It shall be required that the Special Inspections and Testing Agency (SITA) be accredited by IAS according to IAS AC291 and IAS AC89, or be accredited by AASHTO (or AMRL) unless the SITA obtains written approval of their experience performing inspection and testing services on similar projects by the Architect.
2. It shall be required that the Construction Materials Engineer be a Professional Engineer with Construction Materials Engineering experience that is licensed in the State of Texas.
3. It shall be required that the Concrete Inspection Technicians be at least certified ACI (American Concrete Institute) Concrete Field Testing Technicians-Level I, unless the SITA obtains written approval of the technician's experience performing concrete inspection services on similar projects by the Structural Engineer.
4. It shall be required that the Concrete Testing Technicians be at least certified ACI (American Concrete Institute) Concrete Laboratory Testing Technicians-Level I, unless the SITA obtains written approval of the technician's experience performing concrete testing services on similar projects by the Structural Engineer.
5. It shall be required that the Masonry Inspection Technicians be at least certified International Code Council (ICC) Structural Masonry Special Inspector unless the SITA obtains written approval of the technician's experience performing masonry inspection services on similar projects by the Structural Engineer.
6. It shall be required that the Masonry Testing Technicians be at least certified International Code Council (ICC) Structural Masonry Special Inspector unless the SITA obtains written approval of the technician's experience performing masonry testing services on similar projects by the Structural Engineer.
7. It shall be required that the Steel Inspection and Testing Technicians (for both Structural Steel Framing as well as Cold Formed Metal Framing) be certified Associate Welding Inspectors as defined by AWS (American Welding Society) or have a higher certification by AWS unless the SITA obtains written approval of their experience performing inspection and testing services on similar projects by the Structural Engineer.
    a. Steel Inspection Technicians shall have passed within the last 2 years an eye examination with or without corrective lenses to verify the Technician has near vision acuity of Snellen English or equivalent at no less than 12 inches, and far vision acuity of 20/40 or better.

b. Steel Inspection Technicians inspecting bolts shall have a minimum 2 years of experience inspecting bolts as part of regular inspections of structural steel systems.
c. Steel Testing Technicians performing non-destructive testing of welds other than visual shall be certified NDT Level II Technicians in accordance with the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A.

8. It shall be required that the Technician providing special inspection services regarding firestopping at penetrations and joints be an IFC-Certified Inspector with a complete certificate indicating that the technician has passed the online exam and has complete the hands-on product training from at least four (4) firestop product manufacturers, or have written approval by the Architect of experience performing similar inspection services. It shall be permitted for "similar inspection" to be inspection of sprayed fire-resistant material if this experience is supplemented by a certificate or card indicating the technician has completed manufacturer's training on the firestopping material submitted and approved for use on this project.
9. It shall be required that the individual(s) performing any inspection or testing services associated with sprayed fire resistant material (SFRM), mastic and intumescent fire-resistant coatings shall be Certified Fire Inspector I (CFI) by the National Fire Protection Association (NFPA) unless the SITA obtains written approval that the technician's experience performing similar inspections and testing services by the Architect.

B. SITA Scope: Before performing any SITA services on this project, the SITA shall submit to the Architect a statement (e.g. a copy of a fully executed agreement between the Owner and the SITA, or an email from the Construction Materials Engineer to the Architect) for approval by the Architect, indicating that the SITA will perform all work specified in Section 01 4533 to be performed by the SITA. An example of an acceptable statement is, "Our firm will provide all work specified in Section 01 4533 to be performed by the SITA for the [insert project name] located at [insert project address], Huckabee project number [insert project number]."

C. It shall be permitted for the SITA to provide one statement regarding both qualifications and scope.

1.08 APPROVAL OF CXA QUALIFICATIONS AND SCOPE

A. CxA Qualifications: Before performing any CxA services on this project, the CxA shall submit to the Mechanical and Electrical Engineers a statement for approval by the Mechanical and Electrical Engineers indicating that the CxA firm and CxA Staff that will be assigned to this project will meet the qualifications required by Division 01 and Divisions 22-26.

B. CxA Scope: Before performing any CxA services on this project, the CxA shall submit to the Mechanical and Electrical Engineers a statement (e.g. a copy of a fully executed agreement, or an email from the CxA) for approval by the Mechanical and Electrical Engineers, indicating that the CxA will perform all work specified in Division 01, Section 01 4533 and Divisions 22-26 to be performed by the CxA. An example of an acceptable statement is, "Our firm will provide all work specified in Division 01, Section 01 4533 and Divisions 22-26 to be performed by the CxA for the [insert project name] located at [insert project address], Huckabee project number [insert project number]."

C. It shall be permitted for the CxA to provide one statement regarding both qualifications and scope.

1.09 CONTRACTOR'S GENERAL RESPONSIBILITIES

A. It shall be the Contractor's sole responsibility to comply with all requirements of the Contract Documents, without relying on any of the quality control services required by Section 01 4533. The purpose of quality control services is to simply provide some verification that the Contractor is complying with the Contract Documents.

B. As required by the International Building Code, the Contractor shall submit to Humble ISD, the Building Official (AHJ), and the Architect a written "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control".
   1. This statement shall identify this project as " Project Title", including Architect's project number.
   2. The statement shall either include the following language or similar language: "As the Construction Firm responsible for the construction of this project, we acknowledge that we are aware of all the requirements of Specification Sections 01 1400 and 01 4533. In addition, we acknowledge that all firms currently under contract as Subcontractors to our firm on this project are also aware of the requirements of Specification Sections 01 1400 and 01 4533. We further acknowledge that we will make any firms we contract with in the future for this project also aware of these requirements prior to commencement of their scope of work."

C. If any steel fabrication occurs off-site (at a fabrication shop) that is not an AISC certified fabrication shop, the Steel Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication.

D. The Contractor shall notify quality control personnel at least five (5) business days before they need to visit the site to perform their services. In addition, the Contractor shall cooperate with quality control personnel, provide incidental labor, equipment and facilities to give them access to the work (including ladders and lifts), and provide space onsite for their operations and storage.
   1. If the Contractor does not request quality control services where required, the work that was not inspected and/or tested shall be considered deficient and the Contractor shall issue an RFI to the Architect immediately when the Contractor becomes aware of this deficiency.

E. The Contractor shall make accessible and visible all work requiring quality control services until all deficiencies are corrected or otherwise fully addressed.

F. Addressing Deficiencies in SITA Reports: The Contractor shall fully address all deficiencies noted by the SITA and notify the SITA when and how each deficiency was addressed. It shall be permitted to either correct the work in the presence of the SITA, provide evidence to the SITA that there was in fact no deficiency if that is the case, provide evidence to the SITA that the appropriate Design Professional(s) have determined that the deficiency from the contract documents is acceptable, or provide evidence to the quality control entity (e.g. SITA, CxA, or the respective design professional) that a remediation plan was approved by the appropriate Design Professional(s) and then constructed.

G. Addressing Quality Control Observations:
   1. The Contractor shall be responsible for addressing any observations verbally noted by Design Professionals during site visits as if these observations were noted in writing. If the Contractor would like a written record of those observations, the Contractor shall submit a record of their understanding of the conversation to the Architect and Design Professional.
   2. The Contractor shall be responsible for determining if any observations identify or provide evidence of any deficiencies (discrepancies from the contract documents).
   3. All deficiencies associated with observations by Design Professionals shall be addressed by the Contractor.

4. Except for items noted by a Design Professional that are identified in an observation report as “registered”, the Contractor is not required to notify the Design Professional when deficiencies that are associated with observations by Design Professionals have been addressed in good faith by the Contractor. It shall be acceptable for the Contractor to address such items by correcting the discrepancy from the contract documents or determining that a deficiency does not in fact exist. Alternatively, it shall also be acceptable for the Contractor to issue an RFI proposing acceptance of the deficiency or a remediation, and then remediating if approved.
   a. If the Design Professional requests at any time written correspondence that the Contractor has addressed deficiencies associated with any or all observations, the Contractor shall determine whether or not such deficiencies were addressed, resolve any deficiencies that were in fact not yet addressed, and then provide written correspondence indicating that all deficiencies associated with observations by the Design Professional have been corrected when all deficiencies have been corrected.
5. The Contractor shall correct or otherwise fully address all items noted by Design Professionals that are identified in an observation report as “registered”. After registered items have been corrected or otherwise fully addressed but before the Contractor is permitted to install construction which obstructs view of the correction or noted condition, the Contractor shall submit to the Design Professional acceptable evidence of how the item was addressed. The Design Professional shall be the sole determinant of what is considered acceptable evidence and the Design Professional may require a follow-up site visit to make observations. Examples of acceptable evidence might be a photograph emailed by the Contractor, a report from the SITA, or a conversation with the Architect’s representative.

H. If deficiencies are brought to the Contractor’s attention by quality control personnel, the Contractor shall issue a Request For Information (RFI) to the Architect if direction is needed to resolve the item. This RFI shall include the Contractor's suggested course of action to address the deficiency. Unless the Contractor completely removes nonconforming work and replaces it with conforming work, it is the Contractor's responsibility to hire design professionals as required to design any remediation preferred by the Contractor, to be submitted to the Architect for consideration. This RFI may also include a request for acceptance of the deficiency based on an evaluation by the appropriate project design professional(s) such as the Structural Engineer of Record. The entire cost and schedule impact of any deficiencies identified by inspections and/or tests shall completely be the responsibility of the Contractor, at no additional cost to Humble ISD. Humble ISD reserves the right to assess liquidated damages associated with any and all delays due to addressing deficiencies.
   1. If the Contractor would like Design Professional(s) such as the Structural Engineer of Record to design a remediation in lieu of the Contractor hiring design professionals, it shall be permitted for the Contractor to make this request in the RFI. However, project design professional(s) shall have no obligation to design any remediation and shall be permitted to charge for design services. The Contractor shall provide a deadline for the requested design in the RFI, or it may be assumed that the schedule of this resolution is not time-sensitive. If the project design professional(s) do not produce an approved remediation design by this deadline (even if there is no response to the RFI), the Contractor shall either remove nonconforming work and replace it with conforming work or hire design professionals to design a preferred remediation to be submitted for consideration by the Architect. The Contractor shall be responsible for any delays due to attempts by project design professional(s) to design remediation’s by the requested deadline.

I. The Contractor shall pay for all re-inspections and re-tests performed after quality control personnel have identified deficiencies, regardless of who is paying for the basic quality control services. The Contractor shall also pay for any tests, inspections and/or observations not required by Section 01 4533 but requested by the Contractor.

J. The Contractor shall be responsible for paying (either directly or by reimbursing the Owner or Architect) for all additional services by quality control personnel associated with addressing deficiencies.
   1. Design Professionals shall be permitted to bill the Contractor at their standard hourly rates and it shall be the Contractor's responsibility to realize that the Contractor shall be responsible for paying for any time a Design Professional spends performing additional services such as responding to RFI's regarding deficiencies, attending meetings regarding deficiencies, making site visits to address deficiencies.
   2. In general, many Design Professionals do not charge for these services; however, on this project, Design Professionals shall be permitted to bill or not bill the Contractor at their discretion and the Contractor shall be required to pay all such bills.
   3. Design Professionals are not obligated to inform the Contractor in advance what that Design Professional's standard hourly rates are or how much time will be spent or even whether or not that Design Professional intends to submit a bill; the Contractor shall be obligated to ask Design Professionals how much time a task may take and otherwise keep track of these items if the Contractor desires to consider hiring a different Design Professional to assist them in addressing deficiencies.
   4. These additional services are often short duration items scattered over a long period of time; the Design Professionals shall be permitted to send the Contractor a bill for all services associated with addressing deficiencies at the end of the project before a Certificate of Final Completion is issued. The Owner shall be permitted to pay for these services out of the Contractor's Retainage.

1.10 SITA'S GENERAL DUTIES AND RESPONSIBILITIES

A. Role: The Special Inspection and Testing Agency (SITA) shall provide Construction Materials Engineering services, with a Construction Materials Engineer that directly supervises all SITA responsibilities and evaluates whether or not reports from inspections and/or tests conform with construction requirements in the drawings and specifications related to the specific inspections and/or tests required by Section 01 4533.
   1. It shall be the Contractor's sole responsibility to comply with all requirements of the Contract Documents, without relying on any of these quality control services. The purpose of the quality control services provided by the SITA is to simply provide some verification that the Contractor is complying with the Contract Documents.
   2. For clarification, acting under the supervision of the SITA's Construction Materials Engineer, the SITA's personnel shall be permitted to use judgment and experience when measuring dimensions and locations of elements where required by this specification section, to verify conformance with the design intent rather than measuring all instances. For example, where Section 01 4533 requires that the SITA verify locations and or dimensions of all elements for a certain type of construction, it shall be acceptable for the SITA personnel to field measure only a fraction of those dimensions (e.g. "random sampling") when non-measured conditions visually appear to conform, measuring at a frequency determined by the SITA to be appropriate using judgment and experience (rather than field measuring every dimension). Furthermore, the SITA may increase or decrease the frequency of these field measurements depending on how often deficiencies are encountered.
   3. The SITA shall not be permitted to release, revoke, alter, or enlarge on any requirements of Contract Documents; approve or accept any portion of the work; or, assume any duties of the Contractor. The SITA shall not have the authority to stop the work.

B. Contractor's Work Restrictions: The Work Restrictions in Section 01 1400 related to Quality Control require that the Contractor obtain certain documents from the SITA and host certain meeting that the SITA attends, before certain construction milestones for the project to proceed. The SITA shall cooperate with the Contractor, providing those items and attending those meetings within a reasonable time frame.

C. Pre-Construction Meetings: The SITA shall participate (in person or on the phone) at the Foundation Pre-Construction Meeting, Quality Control Pre-Construction Meeting, and Framing Pre-Construction Meeting.

D. SITA Reports: After each special inspection or test, the SITA shall issue a report electronically to the Architect, Contractor, and the Design Professional requiring the report (e.g. concrete cylinder test reports for the foundation shall be submitted to the Structural Engineer), and anyone else the Architect indicates should be included in the distribution (e.g. AHJ, Owner, Construction Observer, etc…). These reports shall include the project title and number and information deemed appropriate by the Construction Materials Engineer.

E. Addressing Deficiencies:
   1. The SITA shall notify the Architect, Contractor and the Design Professional requiring the quality control, of observed deficiencies or non-conformance of work or products.
      a. A draft report of any deficiencies noted during inspections shall be provided to the Contractor on-site in writing (using the method(s) previously agreed to with the Contractor) before the special inspector leaves the site that day.
      b. A final report of inspections shall be issued within five (5) business days of on-site visits. A report of tests performed shall be issued within five (5) business days of performing tests.
   2. Re-inspection and/or re-testing required because of Contractor's non-conformance to the Contract Documents shall be performed by the SITA and shall be paid for by the Contractor. In the event that this occurs, the SITA shall invoice the Contractor directly unless the Owner has indicated it is acceptable to simply bill the Owner and make note that the Owner should be reimbursed for the additional services.

F. The SITA shall provide appropriate quality control staff on-site within five (5) business days of any request by the Contractor to perform inspections and tests required by Specification Section 01 4533, including any re-inspections, retests and/or repeat structural observations.
   1. The Contractor shall be responsible for requesting all site visits necessary for the SITA to perform all quality control services.
   2. If the Contractor does not request inspection, testing, and/or structural observation where required, the work that was not inspected, tested, and/or observed, shall be considered deficient.

G. The SITA shall issue a report to the Architect, Structural Engineer and Contractor if inspection and/or testing indicates that work conforms or does not conform with the contract documents.
   1. If work that is required to be inspected or tested is covered or made permanently inaccessible by the Contractor prior to inspection or testing by the SITA, it shall be assumed that the covered work is non-conforming.

H. The SITA shall comply with the requirements for issuing a Final Report of Special Inspections and Testing required by Section 01 4533.

1.11 QUALITY CONTROL OBSERVATIONS

A. General
   1. The Contractor shall notify every quality control observer (e.g. the CxA and every Design Professional) at least five (5) business days before project conditions are ready for every site visit to make observations that those individuals would like to make.
   2. Quality control observers shall be permitted to issue a written observation report or simply note items verbally in a conversation with any representative of the Contractor onsite. The Architect and/or the Contractor may request written observation reports; however, each Design Professional shall be the sole determinant of if or when written observation reports are issued.

B. Schedule of Site Visits

1. Before the Quality Control Pre-Construction Meeting, the Contractor shall request from the CxA and every Design Professional a description of project conditions which are associated with every desired site visit. (For example, the Structural Engineer may indicate that after rebar is installed for the first grade beam pour but before concrete is poured, he or she would like to send an Engineer-In-Training or an Observer to the site to make observations.)

C. Scope of Observations
1. Site visits desired by Design Professionals but not specifically listed as required in Section 01 4533 are not code-required site visits (e.g. Structural Observations from regular visits by the Structural Engineer or his/her representatives are not the Code-Required Structural Observations listed in other portions of Section 01 4533).
2. The observations are visual observations by the Design Professional, or their representative, of the systems which were designed by the Design Professional and are under construction or were recently constructed, for some verification that this work general conforms to the approved construction documents.
3. The determination of which conditions to note during observation shall be made at the sole discretion of the Design Professional or their representative. These observations may be limited to clear indications noted in which the observer believes the Contractor misunderstood the design intent and the misunderstanding is about a significant requirement. The Design Professional shall not be responsible for identifying any and all significant deficiencies.
4. In written observation reports, the Design Professional shall be permitted to identify certain conditions as “registered” (e.g. registered deficiency, registered observation, registered item, etc…) at the Design Professional’s discretion. The Contractor shall fully address all items noted, regardless of whether they are noted as registered or not; however, the Contractor shall provide the Design Professional with evidence that registered items have been fully addressed and ask the Design Professional if that evidence is sufficient, which provides a higher level of quality control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 QUALITY CONTROL PRE-CONSTRUCTION MEETING

A. The Contractor shall schedule a "Quality Control Pre-Construction Meeting" with the SITA’s Construction Materials Engineer, CxA, Structural Engineer (or a representative of), and the Architect’s Construction Observer. Before scheduling the meeting, the Contractor shall ask the Owner if a representative of the Owner would like to attend. It shall be permitted for people to attend in person or by conference call. During this meeting:
1. The Contractor shall review the approval status of the qualifications and scope statements from the SITA and CxA with all attendees.
2. The Contractor shall acknowledge their responsibility to request site visits for all inspections and tests required by Specification Section 01 4533 before work is made inaccessible or covered. The Contractor shall also acknowledge their responsibility to address all deficiencies.
3. The Contractor, SITA and CxA shall acknowledge their responsibilities to comply with the requirements for Final Reports of Quality Control from firms providing quality control service in Section 01 4533.
4. The Contractor shall provide the construction schedule to all attendees. If this schedule changes during construction, the Contractor shall notify quality control personnel.
5. The SITA and CxA shall summarize their understanding of how Specification Sections 01 1400 and 01 4533 shall be applied to this project.
6. The Contractor shall summarize their understanding of when the Contractor is required to request SITA, CxA and Design Professional site visits for inspections and/or tests.

7. The Architect's Construction Observer shall determine if the site visits described for Design Professionals hired by the Architect generally comply with the Owner-Architect Agreement.
8. The Contractor shall acknowledge their obligation to notify Design Professionals how observations are addressed when observations are noted on reports as "registered".
9. The Contractor and SITA and shall determine collaboratively with each other a mutually agreed upon method for SITA technicians to provide the Contractor with written draft reports of any deficiencies before the technician leaves the site on the day the deficiencies are observed. This method shall not require Contractor's staff to be on-site to receive this draft report. As an example, this could include emailing a specified Contractor email address from smart phones or placing a hard copy of reports in a specified Contractor box outside the job trailer.
10. The SITA and CxA shall each determine collaboratively with the Contractor when the last report from each firm (regarding any portion of the project) is likely to be issued.

3.02 QUALITY CONTROL SPECIFIED BY THE DESIGN PROFESSIONALS

A. Within 7 days after the Foundation Pre-Construction Meeting, the Contractor shall notify the SITA of any special inspections and testing required by delegated design professionals. The SITA shall perform all quality control required by each delegated design professional (hired by the Contractor) to be performed by the SITA. The delegated design professionals shall require quality control that they, in their professional opinion, believe appropriate for the SITA to perform given the nature of the work with consideration given to their understanding of the local industry standard of care. Proposers (potential Contractors) shall assume for proposal purposes that each delegated design professional will require the full scope of special inspections and testing (and structural observation if applicable) listed in the material specific sections and tables of Chapter 17 of the IBC unless told otherwise by the delegated design professional before Proposers submit proposals.

B. Where special inspection and testing is specified by other design professionals (e.g. Architect, Structural Engineer, Civil Engineer, MEP Engineer, etc…) to be performed by the SITA for delegated design items, this work shall be performed at a minimum but shall not be a substitute for the quality control program required by the delegated design professional.

3.03 QUALITY CONTROL SPECIFIED BY THE STRUCTURAL ENGINEER

A. Scope: The quality control required by the Structural Engineer shall apply to all work sealed by the Structural Engineer of Record, the individual who sealed the "S" Sheets.

B. Special Inspections for Soils
   1. Reference SITA Scope on the Drawing Sheets: The SITA shall perform special inspection and testing of the soil below the carton void forms and the subgrade in the crawlspace as required by the Civil Engineer on the Civil Drawing sheets for general site grading and fill, with utility trench backfill as required by the Mechanical and Electrical Engineers on the MEP Drawing sheets as well as the Technology Consultant on the Technology Drawing sheets.

2. Coordination with the Geotechnical Engineer: The SITA shall coordinate inspections and testing of soil with observations by the Geotechnical Engineer, regardless of whether the Geotechnical Engineering Firm is the same firm or a different firm from the SITA firm. The Contractor shall contact the Geotechnical Engineer before the Quality Control Pre-Construction Meeting to determine when the Geotechnical Engineer recommends observations and communicate the schedule on these Geotechnical observations to the SITA. The Contractor shall then notify the Geotechnical Engineer at the appropriate times so that the Geotechnical Engineer can make observations onsite. Where the Geotechnical Engineer recommends that the Geotechnical Engineer be onsite to confirm items (e.g. appropriate depth of a strata, appropriate condition of a strata, anticipated subsurface water conditions, etc…), the SITA shall not perform inspections and testing associated with those items until the Geotechnical Engineer has made such observations.

C. Deep Foundation Elements and Footings
1. The SITA shall observe the installation of all deep foundation elements and/or footings and record all information necessary for the SITA to provide a reliable cost reconciliation by linear foot for each type of deep foundation element and cubic yard of excavation and reinforced concrete for footings. This information shall include the elevation of the grade at the time of drilling, which the SITA may obtain from the Contractor. This information shall also include the elevation of the the bottom of steel casing (or depth below grade at a known elevation), when casing is used. The SITA shall be the sole determinant in the field, for each deep foundation element and for all footings, when sufficient bearing material has been reached and the SITA shall identify for the Contractor, during drilling/excavation, the highest elevations that the SITA considers acceptable so as to assist the Contractor in minimizing work (especially work associated with a unit price adjustment). The SITA shall be the sole determinant in the field, for each deep foundation element, when casing is required and the SITA shall identify for the Contractor, during drilling, the fewest piers the SITA considers necessary to case and the highest elevations that the SITA considers acceptable for the bottom of casing at each pier so as to assist the Contractor in minimizing work (especially work associated with a unit price adjustment).
2. After the Contractor indicates that the last Deep Foundation Element has been installed, the Contractor shall request a Deep Foundation Element Reconciliation Report from the SITA. The SITA shall then provide a tabulation of the difference between assumed and actual conditions for the total cumulative length of uncased deep foundation elements, and cased piers where applicable, for each diameter and reinforcement pattern. The Contractor shall then calculate the change in cost associated with the Pier Reconciliation Report from the SITA and then submit a Request for Information, asking the Architect and any appropriate Design Professionals to review the report and proposed cost change before a Proposed Cost Revision is submitted.

D. Special Inspections and Testing for Concrete Construction
1. Before requesting that SITA personnel visit the site to make inspections of concrete work, the Contractor shall electronically send to the SITA any applicable reinforcement shop drawings and concrete mix design submittals that have been reviewed by the specifying Engineering Firm. The Contractor shall give the SITA sufficient time and lighting at the site, as deemed necessary by the SITA, to perform the specified inspections and testing.
2. The SITA shall provide the following inspections and testing for concrete construction.

a. Before every concrete pour (generally the same day of the pour unless the SITA deems the scope of the pour to be too large), the SITA shall visit the site and inspect the reinforcement for conformance with the reviewed shop drawings, to the extent that the SITA deems appropriate under the supervision of the Construction Materials Engineer (e.g. yield strength, size, spacing, concrete cover, etc…at a random sampling to be determined by the SITA). While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to anchor bolt embedment, steel embed plate type and location, formwork, concrete accessories, debris, etc.…

b. During concrete pours, for each intended use (e.g. footing, grade beam, interior slab on grade, etc…), the SITA shall sample concrete from the first concrete truck on each day of concrete pouring and shall determine which other concrete trucks they will sample each day, if any. The SITA shall, however, sample trucks so that no more than 150 cubic yards of concrete is placed at a time without being sampled (e.g. sampling every 150 cubic yards). While onsite, the SITA shall be empowered but shall not be obligated to make comments during inspections regarding related conditions, including but not limited to unsafe conditions, age of concrete in trucks after batching before poured, vibration of concrete, hot weather and cold weather concrete placement methods, temperature and wind speed for the pour that day, and curing conditions for previously poured areas.

c. For each truck that is sampled, the SITA shall do the following and notify the Contractor immediately of any deficiencies so that the Contractor has an opportunity to address those deficiencies:
   1) Collect a copy of the batch ticket and verify that the mix design matches the reviewed submittal for the intended use;
   2) Collect a sample in accordance with ASTM C172.
   3) Perform a slump test in accordance with ASTM C172 and verify that the slump is within the range on the submittal;
   4) Perform an air content test in accordance with ASTM C231or ASTM C173 and verify the air content is within the range on the submittal;
   5) Record the concrete temperature;
   6) Fabricate cylinders molded and standard-cured in accordance with ASTM C31. Each set of cylinders shall consist of either four cylinders that are 6” in diameter and 12” tall or five cylinders that are 4” in diameter and 8’ tall. The Contractor shall be responsible for providing a portion of the site to the SITA for cylinder storage; however, the proper temperature and humidity of curing of all test cylinders and protection of curing on the jobsite shall be the responsibility of the SITA and not the Contractor. The SITA shall also be responsible for transportation from the field to the laboratory. All test cylinders shall be stored in the field 24 hours and then be carefully transported to the laboratory and cured in accordance with ASTM C31.
   7) The Contractor shall have the option to pay the SITA to perform additional inspections and testing, such as additional concrete cylinders whenever desired to determine early strengths. The Contractor shall be responsible for any additional cylinders required to comply with OSHA requirements.

d. For each set of concrete cylinders fabricated, the SITA shall perform compression strength testing in accordance with ASTM C 39 with one (1) cylinder at 7 days and either two (2) 6” diameter cylinders or three (3) 4” diameter cylinders at 28 days. The SITA shall hold one cylinder in reserve and test the reserve cylinder at 56 days only if the average of the 28 day cylinder strengths is below the specified strength and the specifying Engineer indicates it is acceptable to test at 56 days rather than waiting a longer period of time.

E. Special Inspections and Testing for Masonry Construction

1. Before requesting that SITA personnel visit the site to make inspections of masonry work, the Contractor shall electronically send to the SITA any applicable reinforcement shop drawings and mortar/grout mix design submittals that have been reviewed by the Structural Engineering Firm. The Contractor shall notify the SITA of the rate of masonry construction as it occurs so that the SITA is onsite the first day of structural masonry work and no more than 5,000 square foot of structural masonry is constructed at a time without the SITA being onsite for inspections and testing (e.g. notifying the SITA every 5,000 square feet). The Contractor shall also coordinate the SITA site visits such that structural masonry work is occurring (e.g. masons are installing masonry) when the SITA is performing inspections and tests. Structural masonry for the purposes of quality control is hereby defined as all reinforced concrete masonry walls which are exterior walls and load-bearing walls.
2. The SITA shall provide the following inspections and testing for masonry construction:
    a. The first day of masonry work, the SITA shall observe the mason mixing the first batches of both mortar and grout, verifying the following (with the mason preparing a batch of mortar or grout for inspection purposes only, to be discarded, if no mortar or grout is needed that day):
        1) the ingredients appear to be consistent with the reviewed mix submittals (e.g. the type of cementitious materials listed on bags appear correct);
        2) the volumetric proportions are consistent with the reviewed mix submittals; and,
        3) containers with known volume are used when batching (allowing the mason to assume that a bag of cement weighing at least 92 pounds is a cubic foot), verifying that shovels are not used when proportioning sand or gravel.
    b. At every visit for inspections and testing of masonry construction, the SITA shall do the following:
        1) Inspect bedjoint reinforcement and vertical as well as horizontal conventional reinforcement where work is exposed (i.e. constructed but not obstructed from view with grout or masonry) for conformance with the reviewed shop drawings, to the extent that the SITA deems appropriate under the supervision of the Construction Materials Engineer (e.g. yield strength, size, spacing, masonry cover, etc…at a random sampling to be determined by the SITA);
        2) Inspect grout spaces to verify they are clear of debris;
        3) Sample grout and fabricate a set of three (3) grout prisms (grout only, formed with CMU on all sides, and not a masonry prism which is constructed with two units and a mortar joint) and test in the lab at 28 days in accordance with ASTM C 1019. The Contractor shall be responsible for providing a portion of the site to the SITA for prism storage; however, the proper temperature and humidity of curing of all test prisms and protection of curing on the jobsite shall be the responsibility of the SITA and not the Contractor. The SITA shall also be responsible for transportation from the field to the laboratory.
            (a) every time grout is sampled to make prisms, the SITA shall perform a slump test and verify that the slump is greater than 8”.
        4) While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to use of integral water repellant in mortar mixes where specified, mortar mixing, grout mixing, grouting where post-installed anchors will be required, anchor bolt embedment of embedded anchor bolts, steel embed plate type and location, masonry accessories, veneer anchors, debris, lift height for grouting, age or segregation of mortar or grout when placed, vibration, hot weather and cold weather practices, material certification for masonry units, proper face-shell bedding, bracing of previously constructed non-loadbearing masonry walls, and curing conditions for previously constructed walls.

5) Mortar cubes and masonry prisms are not required. If the SITA produces mortar cubes or masonry prisms without the Owner's authorization, the Owner will not pay for mortar cube preparation or mortar cube testing. The Contractor shall be permitted to request and pay for mortar cubes or masonry prisms, if the Contractor desires.

F. Special Inspections and Testing for Steel Construction

1. Before requesting that SITA personnel visit the site to make inspections of structural steel work, the Contractor shall electronically send to the SITA copies of the welding certifications for every steel welder that will be onsite, manufacturer certification for every adhesive anchor installer that will be onsite and any applicable structural steel submittals that have been reviewed by the Structural Engineering Firm. Upon receipt of the welding certifications, the SITA Staff shall verify these welders have passed qualification tests within the last year using procedures covered in the American Welding Society "Structural Welding Code - Steel," D1.1, latest version. Upon receipt of the adhesive anchor certifications, the SITA Staff shall verify these installers do not have an expired certification. The inspector (acting under the supervision of the Construction Materials Engineer) shall be permitted to accept alternative experience and/or on site demonstration of competency if qualified in the opinion of the inspector.
2. Inspection and Testing at Non-AISC Fabrication Shops: If any steel fabrication occurs off-site at a fabrication shop that is not an AISC certified fabrication shop (excluding Steel Joist Institute facilities manufacturing steel joists), the Steel Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication. The Contractor shall notify the SITA when fabrication of steel is scheduled to begin at these facilities. The SITA shall visit these facilities at the beginning of steel work within those facilities and review the quality assurance / quality control documentation at that facility (e.g. processes, welder certifications, logs of welding inspections, etc…). The SITA Staff, acting under the supervision of the Construction Materials Engineer, shall then determine how much (if any) of the specified inspection and testing for on-site steel construction shall apply to the non-AISC-certified shop construction, and then perform that scope of work after communicating to the Contractor when the SITA is to be notified for inspections at the shop. For proposal purposes, Steel Fabricators with non-AISC shops shall assume that the SITA Staff will require the full scope of inspection and testing for on-site steel construction shall apply to the non-AISC-certified shop construction.
3. On-Site Inspection and Testing: The Contractor shall notify the SITA of the status of steel construction as it occurs so that the SITA is onsite after defined areas of the structural steel portion of the project are complete (with the exception that the SITA must be present during the installation of any overhead adhesive anchors), notifying the SITA of any work within those areas that is to be completed at a later date. The Contractor shall not cover up portions of steel construction until the SITA has performed quality control services without identifying any deficiencies at those areas. By the end of the project, the Contractor shall have scheduled visits from the SITA for steel inspection and testing of all structural steel construction (including all miscellaneous steel members but not including cold formed metal framing) that occurred on-site. During each sitevisit, the SITA shall do the following:
    a. Verify off-site fabrication occurred at an AISC certified fabrication shop (by obtaining a copy of the shop's certificate), unless the SITA has provided the specified inspection and testing services at the fabrication shop.
    b. Structural Steel Members: Verify that the structural steel framing member sizes and locations generally conform to the reviewed steel submittals.

c. Welds that are not Full Penetration welds: Out of all the welds in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which welds to visually inspect (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall inspect at least 10% of each type of weld. The SITA shall be permitted to inspect up to 100% of each type of weld if the SITA Staff believe appropriate, based on the conditions observed. The Contractor shall clean all welds identified for visual inspection by the SITA. Visual inspection of welds shall include but not be limited to alignment of members, weld size, length, location, weld/base-metal fusion and signs of cracking.

d. Welds that are Full Penetration welds:
   1) the Contractor shall clean all full-penetration welds. The SITA Staff shall visually inspect all full-penetration welds.
   2) out of all the full-penetration welds in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which welds receive Ultrasonic Testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall perform Ultrasonic Testing on at least 10% of each type of full-penetration weld (e.g. normal full-penetration, flare vee, etc…). The SITA shall be permitted to perform Ultrasonic Testing on up to 100% of each type of full-penetration weld if the SITA Staff believe appropriate, based on the conditions observed.

e. Bolts:
   1) Load-Indicator Type Bolts: Out of all the load-indicator bolts in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which load-indicator bolts receive inspection and testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall visually inspect at least 10% of each type of load-indicator bolt. The SITA shall be permitted to visually inspect up to 100% of the load-indicator bolts if the SITA Staff believe appropriate, based on the conditions observed. Visual inspection and testing of load-indicator bolts shall include verification that the grade, diameter, location, and minimum length generally conform with the reviewed steel submittals, and that the splines have been snapped off to indicate proper torquing. If any steel to steel connections do not utilize load-indicator type bolts, this section shall apply.
   2) Anchor Bolts that are not Overhead Adhesive Anchor Bolts: Out of all the anchor bolts (including base plate anchor bolts, expansion bolts, and adhesive anchor bolts but excluding overhead adhesive anchor bolts) in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which anchor bolts receive inspection and testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall visually inspect at least 10% of each type of anchor bolts. The SITA shall be permitted to visually inspect up to 100% of the anchor bolts if the SITA Staff believe appropriate, based on the conditions observed. Visual inspection and testing of anchor bolts shall include verification that the bolts are snug tight in the opinion of the SITA, wedge anchors are fully torqued and no longer able to rotate, and verification that the grade, diameter, location, and minimum length beyond the nut generally conform with the reviewed steel submittals.
   3) Overhead Adhesive Anchors: The SITA Staff shall be present during the installation of all adhesive anchors oriented vertically such that the anchors are in tension, if there are any such anchors on the project. During the installation, the SITA shall visually inspect the bolts as with all other anchor bolts and inspect the installation, commenting if the installation does not appear to be consistent with the manufacturer's recommended installation procedures.

f. Metal Deck: For all metal deck, verify the type, gauge, finish, weld pattern and sidelap connections conform with the reviewed deck submittals.

g. While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to unsafe conditions, counterfeit steel members and/or bolts, galvanized steel being cut/scratched/welded (which is not permitted), exterior exposure of non-galvanized material that is not to be painted, welding procedures, steel angle supports around openings in metal deck, deck closures, fire protection, removal of backer plates, grinding of exposed welds, temporary or permanent bracing, and visual acuity of welders.

3.04 QUALITY CONTROL SPECIFIED BY THE CIVIL ENGINEER

A. Reference Civil drawings for quality control required by the Civil Engineer.

3.05 QUALITY CONTROL SPECIFIED BY THE ARCHITECT

A. Special Inspections for Sprayed Fire Resistant Materials
   1. Sprayed Fire Resistant Materials, General:
      a. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies shown in the approved contract documents.
      b. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
   2. Physical and visual tests: Verify compliance with fire resistance rating.
      a. Condition of substrates; periodic
      b. Thickness of sprayed fire resistant material; periodic.
      c. Density of sprayed fire resistant material in pounds per cubic foot; per model building code.
      d. Bond strength (adhesion and cohesion); per model building code.
      e. Condition of finished application; per model building code.
   3. Structural member surface conditions:
      a. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
      b. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.
   4. Application:
      a. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
      b. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
   5. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
      a. Minimum Allowable Thickness: Tested according to ASTM E605, random.
         1) Design thickness 1 inch or less: Design thickness minus 1/4 inch.
         2) Design thickness greater than 1 inch: Design thickness minus 25 percent.
      b. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605 with no less than four measurements per 1,000 square feet of sprayed area on each story of the structure or portion thereof; random.
         1) Cellular Decks: Measure thickness within a single 12 inch by 12 inch area. Make a minimum of four measurements arranged symmetrically in testing area.
         2) Fluted Decks: Measure thickness within a single 12 inch by 12 inch area. Make a minimum of four measurements arranged symmetrically in testing area and include one example each of valley, crest and sides. Report the average of the four measurements.

c. Structural Members: Test according to ASTM E605. Test no less than 25 percent of structural members on each story of the structure or portion thereof; random.
   1) Beams and girders: Make nine thickness measurements around beam or girder at each end of a 12 inch by 12 inch length.
   2) Joists and trusses: Make seven thickness measurements around joist or truss at each end of a 12 inch by 12 inch length.
   3) Wide flanged columns: Make twelve thickness measurements around column at each end of a 12 inch by 12 inch length.
   4) Hollow structural sections and pipe columns: Make four thickness measurements around hollow structural section or pipe column at each end of a 12 inch by 12 inch length.

6. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.
   a. Floor, Roof and Wall Assemblies: Test according to ASTM E605 with no less than one sample per 2,500 square feet of sprayed area on each story of the structure or portion thereof; random.
   b. Beams, Girders, Trusses and Columns: Test according to ASTM E605 with no less than one sample per 2,500 square feet of sprayed area on each story of the structure or portion thereof; random.
7. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736 and as described below.
   a. Floor, roof and wall assemblies: Test no less than one sample per each 2,500 square feet of sprayed area on each story of the structure or portion thereof; random.
   b. Structural members: Test no less than one sample from each type of structural member in each 2,500 square feet of each story of the structure or portion thereof; random.
   c. Primer, paint and encapsulant bond tests: When sprayed fire resistant material is applied to a primed, painted or encapsulated surface for which acceptable material to substrate performance has not been determined, conduct bond test.

B. Special Inspections for Mastic and Intumescent Fire Resistant Coatings
   1. Verify mastic and intumescent fire resistant coatings comply with AWCI 12-B and the fire resistance rating shown on the approved contract documents.

C. Special Inspections for Firestopping Penetrations and Joints
   1. Before the installation of any firestopping at penetrations and joints, the SITA shall verify that the installer of firestopping at penetrations and joints is an FM4991 “Approved Standard for Firestop Contractors” approved firestop contractor or UL Qualified Firestop Contractor.

2. The SITA shall inspect firestopping at penetrations in accordance with ASTM E 2174 “Standard Practice for On-Site Inspection of Installed Fire Stops” for each type of firestop being used. A unique “type” shall be defined by the UL Fire Resistance Directory utilizing UL’s alpha-alpha-numeric numbering system based on a specific combination of penetrant, substrate and firestop product. For each type of penetration, inspections shall be by either witnessing the entire installation of 10% of the penetrations. Alternatively, for each type of penetration that is not a pre-formed firestopping penetration device, inspections shall be permitted to be by the SITA removing a portion of the firestopping at 2% of the penetrations, verifying the proper depth of installation (and compression at mineral wool, if applicable) and the firestopping installer replacing the firestopping in the presence of the SITA. For preformed-devices, the inspection shall be either by witnessing 10% of the installation of each type of firestop, or alternatively by a post-installation verification that the installed system complies with the reference listed system or engineering judgment. If non-compliant conditions are encountered by the SITA, the SITA shall proceed as directed by ASTM E 2174.
3. The SITA shall inspect firestopping at joints in accordance with ASTM E 2393 “Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers” for each type of firestop being used. A unique “type” shall be defined by the UL Fire Resistance Directory utilizing UL’s alpha-alpha-numeric numbering system based on a specific combination of joint type (head of wall, wall to wall, floor to wall, floor to floor, floor to exterior wall) firestopping material or system (for example, intumescent, caulk, mortar, sealant, mechanical, factory preassembled), and substrates (for example, gypsum wall, concrete floor, composite floor deck). For each type of joint, inspections shall be by either witnessing 5% of the total lineal feet to be installed on the project. Alternatively, inspections shall be permitted to be by the SITA removing at least 1 foot every 500 linear feet of the firestopping on the project, verifying the proper depth (and compression at mineral wool, if applicable) of installation and the firestopping installer replacing the firestopping in the presence of the SITA, or in the case of a pre-formed firestopping joint device, by verifying that the device has been installed in accordance with the reference listed system or engineering judgment. If non-compliant conditions are encountered by the SITA, the SITA shall proceed as directed by ASTM E 2393.
4. If at any time, material removed by the SITA from penetrations and/or joints for a type does not conform to the project requirements, the SITA shall double the amount of destructive testing for that type unless the penetrations and joints were installed by SITA witnessing installation. Further non-compliance shall be addressed as directed by ASTM E 2174 and/or ASTM E 2393. If at any time, installation of firestopping at penetrations and/or joints does not conform with the contract documents while being witnessed by the SITA inspector, the SITA inspector is to proceed as directed by ASTM E 2174 and/or ASTM E 2393. Non-compliance according to these ASTM’s may lead to work stoppage that requires approval by the AHJ to resolve the non-compliance.

3.06 QUALITY CONTROL SPECIFIED BY THE MECHANICAL AND ELECTRICAL ENGINEERS

A. The CxA shall visit the site to make observations as specified by Section 01 9100, Section 01 4533 and Divisions 22-26.

3.07 FINAL QUALITY ASSURANCE REPORTS

A. General
1. Before applying for a Certificate of Occupancy, the Contractor shall obtain a Final Report from each of the following quality control firms and submit them all at one time to the AHJ:
   a. SITA, Final Report of Special Inspections and Testing
   b. CxA, Final Report of Commissioning
   c. Structural Engineer, Final Report of Structural Engineering Observations
   d. Mechanical Engineer, Final Report of Mechanical Engineering Observations
   e. Electrical Engineer, Final Report of Electrical Engineering Observations

2. Quality assurance personnel shall not be required by the AHJ to issue any certifications, guarantees, or warranties because that is not in their scope of work. Specific language or formatting of the final report shall not be considered a requirement by the AHJ for this project unless the AHJ indicates otherwise before a building permit is issued. (If specific language is desired, quality assurance personnel would need to understand that specific language before performing their scope of work to ensure that they can accurately write a letter with that language.)
3. The Final Report from every firm providing quality control services shall be sealed by a Professional Engineer licensed in the State of Texas and shall indicate, if it is true, that the author of the Final Report:
    a. Represents the firm, identifying which quality control services were provided by that firm,
        1) Has reviewed all previous reports and believes all of the quality control services required by Section 01 4533 to be performed by their firm have been performed,
        2) Has reviewed all previous reports and believes there are no unresolved deficiencies, and,
        3) To the best of his or her knowledge, regarding the portion of the project associated with their scope of work, they believe the construction conforms.
            (a) The SITA shall indicate they believe the results of inspections and testing were within project specifications.
            (b) Quality control observers shall indicate they believe the construction generally conforms with the contract documents.
4. An example of acceptable language in a Final Report is as follows:
    a. For the SITA: “I am the Construction Materials Engineer representing [insert SITA firm’s name], which was responsible for providing Special Inspections and Testing Agency (SITA) services for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I have reviewed all previous reports from our firm and believe all of the quality control services required by Section 01 4533 of the Project Manual to be performed by the SITA have been performed. I have also reviewed all previous reports from our firm and believe there are no unresolved deficiencies. To the best of my knowledge, regarding the portion of the project associated with our firm’s scope of work, I believe the results of inspections and testing were within project specifications.”
    b. For the CxA: “I am the individual representing [insert CxA firm’s name], which was responsible for providing Commissioning (CxA) services for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I have reviewed all previous reports from our firm and believe all of the quality control services required by Section 01 4533 of the Project Manual to be performed by the CxA have been performed. I have also reviewed all previous reports from our firm and believe there are no unresolved deficiencies. To the best of my knowledge, regarding the portion of the project associated with our firm’s scope of work, I believe the construction generally conforms with the contract documents.”
    c. For the Structural Engineer, Mechanical Engineer and Electrical Engineer: “I am the [insert project role] representing [insert firm’s name], which was responsible for providing observations for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I and/or a representative of my firm visited the site at certain stages of construction and made observations. The Contractor is obligated to address all of my observations and has indicated to me that this was done. Therefore, to the best of my knowledge, I believe the construction related to my role generally conforms with the contract documents.”

B. Request for Final Report

1. Within 48 hours of receiving the last inspection, test or observation report expected for the project (regarding any portion of the project) from each firm providing quality control services, the Contractor shall issue an RFI requesting a Final Report of Quality Control from that firm. For clarification, the Contractor shall not be permitted to wait until the end of the project or even until all quality control firms have completed their work. The Contractor shall be responsible for addressing any unresolved deficiencies and submit a written statement to all quality assurance observers in the RFI that their observations were fully addressed before requesting this report from each firm. For proposal purposes, the Contractor shall assume that within ten (10) business days each firm providing quality control services will either issue this report without any unresolved deficiencies or identify in writing any known but unresolved deficiencies. If any unresolved deficiencies are identified during this process, the Contractor shall address these deficiencies and then request a final report again.
2. When the Contractor requests a Final Report of Quality Control from each quality control firm, quality control personnel shall verify that the scope of quality control services required by Specification Section 01 4533 was performed and that any deficiencies identified have been addressed.
   a. If it appears there are no unresolved deficiencies, the firm shall create and distribute a Final Report within ten (10) business days of receiving the request from the Contractor for the final report. The final report shall be sealed by a professional engineer licensed in the state of Texas and shall be distributed to the Contractor and the Architect.
   b. If the firm determines that there are unresolved deficiencies, the firm shall notify the Contractor within ten (10) business days of receiving the request from the Contractor for the Final Report that a Final Report cannot be provided until all unresolved deficiencies are resolved. It is preferred but not required that the firm also provide the Contractor a complete list of all deficiencies identified by the firm to date.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

H. Field offices.

1.02 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes including review and inspection of work.

B. New permanent facilities may not be used.

1.03 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. New permanent facilities may not be used during construction operations.

D. Maintain daily in clean and sanitary condition.

E. At end of construction, return facilities to same or better condition as originally found.

1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas., to allow for owner's use of siteProtect existing facilities and adjacent properties from damage from construction operations and demolition. Implement safety precautions that comply with all regulatory requirements.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

C. On sites where students are present, no work shall commence prior to fence being in place.

1.06 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.07 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Paint surfaces exposed to view from Owner-occupied areas.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.09 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Do not allow vehicle parking on existing pavement.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. If materials to be recycled or re-used on the project must be stored on-site, provide suitable and secure non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

A. No later than ten (10) days after the Notice to Proceed, and prior to start of construction, provide a job sign at the job site.

B. Request sign layout and details from the Architect.

C. Contractor shall be responsible to pick up sign.

D. Provide project identification sign of design and construction indicated on drawings.

E. Erect on site at location indicated.

F. No other signs are allowed without Architect's permission except those required by law.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack .

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Provide separate work station similarly equipped and furnished, for use of Architect..

D. Locate offices a minimum distance of 50 feet from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to final punch list and review inspection.

B. Remove underground installations to a minimum depth of 3 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5639
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Tree preservation work includes, but is not limited to:
1. Protection of existing trees and all other indicated to remain in place.
Maintenance of protected areas.
2. Clearing and grubbing activity within protected areas.
Damage compensation.

1.03 APPLICABLE REGULATIONS

A. Comply with all applicable local laws and regulations concerning tree preservation as well as the specific requirements stated elsewhere in the Specifications.

PART 2 - PRODUCTS (NOT USED)

EXECUTION

3.01 PROTECTION OF EXISTING TREES TO REMAIN

A. Tagging and Fencing
1. Trees to remain shall be tagged and protective fencing installed prior to any construction, demolition, or other disturbance.
Protective fencing shall be installed at the dripline of the tree to be protected unless otherwise noted on the Plans.
2. The area inside the protective fencing will heretofore be referred to as the protected area.
The Contractor shall verify tagged trees and fence locations in field with the Landscape Architect prior to any construction or demolition activity.

3.02 MAINTENANCE OF PROTECTED AREA

A. No construction activity shall occur inside protected areas other than that landscape construction which is required for completion of the project.
1. Construction activity includes, but is not limited to, building material storage, waste stockpiling, topsoil stockpiling, equipment storage or parking, disposal of waste materials of any kind, draining or flushing of tanks, canisters, drums, or other containers, trailer parking or storage, and demolition activity.

B. No traffic, vehicular or pedestrian, shall encroach upon protected areas.
1. This includes, but is not limited to, personal passenger vehicles, construction vehicles, grading machinery, and loading/lifting machinery.

C. No material, machine, vehicle, or part thereof shall encroach above or below the vertical plane of the protective fencing into the protected area.

The Contractor shall notify the Landscape Architect of any activity which might infringe or encroach upon the protected area prior to start of said activity.

3.03 ENCROACHMENT UPON PROTECTED AREA

A. If encroachment into the protected area does occur, notify the Landscape Architect immediately.

3.04 ACTIVITY INSIDE PROTECTED AREAS END OF SECTION

A. Clearing and Grubbing:

1. Clearing of small trees, shrubs, and herbaceous plants in the protected area shall be performed by hand only.

Bulldozers and/or drag chain operations are not permissible inside protected areas.

2. Grubbing of stumps shall be performed in two (2) ways:
   a. Under 6" diameter shall be pulled by chain.
      1) The vehicle used for pulling shall remain outside the protected area (dripline of the tree to remain) whenever possible.

      Under no circumstance shall the pulling vehicle encroach into the protected area by more than 1/3 of the distance from the trunk of tree to remain to the nearest edge of the protected area (dripline).

      2) Any depressions shall be filled with topsoil and leveled to grade by hand.
   b. Stumps over 6” diameter shall be ground out to a depth of 4” below grade.
      1) Stump grinder shall be trailer mounted and maneuvered by light truck or bobcat.

      Wood chips generated by grinding shall be removed and any depressions shall be filled with topsoil and leveled to grade.

      2) These operations shall be performed by hand.

B. Grading:

1. Any grading which may be required inside the protected area shall be performed by hand only.

No grading or earthmoving machinery shall be allowed inside the protected area.

2. Provide grade stakes and verify grade elevations with the Landscape Architect prior to commencement of any grading activity.

C. Preparation of soil for seeding and/or sodding within the protected areas shall be done by hand or with a power rake and shall not disturb soil more than 2" deep to prevent damage to feeder root systems.

1. Chemical herbicides shall be used within protected areas unless the Contractor can obtain written manufacturer's guarantee that herbicide will not harm tree health or growth and obtain written approval from the Landscape Architect.

Contact the Landscape Architect prior to seed or sod preparation within protected areas to determine exact seed and/or sod limits.

D. Stake locations of all utilities which encroach protected areas.

1. Contact the Landscape Architect prior to clearing or trenching for utilities to verify that staked location is the least obtrusive to protected area.

3.05 REMOVAL OF PROTECTIVE FENCING

A. Protective fencing may be removed to facilitate landscape work in the protected area.

1. All Work in the protected area shall be initiated within 24 hours of fence removal.
2. If landscape work in the protected area is delayed or interrupted for more than 24 hours, then protective fencing shall be reinstalled until such time as work in the protected area is resumed.

Protective fencing shall be reinstalled after substantial completion of work inside protected area and shall remain until substantial completion of the project or approval of the Landscape Architect, whichever is later.

3.06 DAMAGE COMPENSATION

A. Any damage occurring to trees to remain or protected areas or removal of trees to remain in the protected areas caused by neglect, unauthorized encroachment and/or inadequate protection enforcement as

1. Financial Compensation for said damage or removal shall be determined by the Landscape Architect and Owner as per the following guidelines on a per occurrence basis.

END OF SECTION

SECTION 01 5719
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Testing indoor air quality before commencement of construction; existing building areas only.

C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.

B. ASHRAE Std 129 - Measuring Air-Change Effectiveness.; 1997 (Reaffirmed 2002).

C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2010.

D. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.

7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

E. Indoor Air Quality Testing Plan: Identify:
1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

F. Indoor Air Quality Testing Reports: Show:
1. Location where each sample was taken, and time.
2. Test values for each air sample.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.
6. Interpretation of test results.
7. Recommendations for improvement of indoor air quality or retesting.

1.06 QUALITY ASSURANCE

A. Firm Qualifications: The indoor air quality testing firm must have a minimum of five years experience specifically in the indoor environmental quality field and must have indoor environmental testing and consulting capabilities. Firm should be a licensed mold assessment company (ACO) through the Texas Department of Licensing and Regulation (TDLR), and should have a minimum of one mold assessment consultant (MAC) on staff. Additionally, the firm's consultants should maintain current certification in indoor environmental consulting (i.e. Certified Indoor Environmental Consultant (CIEC) through the American Council for Accredited Certification (ACAC) or other certifying association. The firm should employ a LEED-Accredited Professional, certified by the United States Green Building Council (USGBC).

B. Laboratory Qualifications: The microbiology testing laboratory utilized by the consulting firm should have a minimum of five years experience, be a licensed mold analysis laboratory through the Texas Department of Licensing and Regulation (TDLR), and should employ a degreed mycologist. The industrial hygiene laboratory utilized by the consulting firm should have a minimum of five years experience, and be accredited by the American Industrial Hygiene Association (AIHA).

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area. Provide pre-construction air filters to all return air registers in adjacent occupied areas.

E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 INDOOR AIR QUALITY TESTING (IAQ)

A. On-site Observations
   1. A minimum of two (2) visits for renovations and up to six (6) site visits for new construction will be made to the site to conduct on-site observations during the construction phase relative to water intrusion issues or other building conditions that might cause future degradation to indoor air quality. These observations may include but are not limited to landscape grade and drainage, foundation height, exterior wall sealing, roof and wall enclosure penetrations, water or moisture intrusion, plumbing, storage and condition of absorbent building materials, sealing and hygiene of HVAC systems, control of particulates, etc.
   2. This phase may also include a review of specifications for building products such as paint, adhesives, carpet, and cabinetry for products that might degrade future indoor air quality when installed.
   3. A written report will be submitted to the Architect or Owner's representative after each on-site observation. The report will include project conditions on the day of inspection along with cited potential problems areas and photo-documentation as needed.
      a. Critical Condition Report: If a condition is cited that may cause potential microbial contamination in area that is ready to be sealed or covered, a verbal report will be communicated to the Architect or Owner's representative within one business day so the Contractor can have the condition corrected before work is continued.
      b. Standard Report: A written report will be submitted to the Architect or Owner's representative within ten (10) working days of the site visit.

B. Pre-Construction Inspection and Sampling: Perform indoor air quality testing before starting construction, as base line for evaluation of post-construction testing.

1. If the construction project is an addition to an existing facility, pre-construction inspection and sampling will be conducted to determine baseline conditions within the existing facility.
2. The testing conducted in item C-2 of the pre-occupancy testing below will be conducted in areas of the existing facility that will be adjoining the new construction.
3. During construction activities on-site observations will include any impact to the indoor air quality of the existing facility.

C. Pre-Occupancy Inspection and Sampling: Perform indoor air quality testing before occupancy.
1. After substantial completion of the facility and before non-fixed furnishings are delivered, the firm will conduct an IAQ inspection and perform representative sampling for indoor air quality parameters. These measurements will establish background pre-occupancy conditions, and will be evaluated for acceptable levels. All samples collected will be area screening samples to determine the presence of the parameters of interest. If the screening results indicate significant positive results, additional investigation may be required.
2. The air quality sampling includes the collection of samples for the determination of populations and concentrations of total fungal bioaerosols in the ambient air. The sampling also includes the collection of chemical samples for fixed gas analysis for total volatile organic compounds (TVOCs), methane, carbon dioxide, and carbon monoxide. Additional real-time monitoring will be conducted for the following parameters: temperature, relative humidity, carbon dioxide, carbon monoxide, TVOCs, ozone, and large (2.5 to 10 microns) and small particulates (<2.5 microns).
3. Testing in a school facility will include the collection of samples in representative areas of the classroom wings (to include a minimum of 20% of the classrooms), and if part of the new construction, in the cafeteria, library, administration offices, gymnasium, and locker rooms. Additionally, two outdoor samples will be collected on each day of testing for comparison purposes.
4. If significant areas of rubber-backed carpeting and/or composite fixed furnishings are present in the facility, testing will also be conducted in representative areas for 4-phenylcyclohexene and formaldehyde in the ambient air. This testing will not be conducted if carpeting and fixed furnishings have been installed which are certified to be free of these chemicals.
5. Testing for radon should be conducted only for subterranean structures or in geographical areas where radon has been previously documented on a reoccurring basis.
6. Testing for lead-based paint and asbestos-containing materials will not be conducted unless there is an indication that lead-based paint and/or asbestos-containing materials may be present in the existing structure, and that it may be impacted by the new construction activities. Historical asbestos testing records, asbestos management plans, or lead-based paint surveys may be provided in lieu of testing.
7. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.

D. Do not start pre-occupancy indoor air quality testing until:
1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Cleaning of inside of HVAC ductwork, if specified elsewhere, has been completed.
4. New HVAC filtration media have been installed.

E. Post-Occupancy Inspection and Sampling:
1. At five (5) months and eleven (11) months following substantial completion, but prior to the one (1) year project inspection, the testing conducted in item C-2 of the pre-occupancy testing above will be repeated.
2. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.

F. Indoor Air Quality Acceptance Criteria
   1. Upon completion of the project, the indoor air quality testing firm will provide a report of findings to the Architect or Owner's representative indicating any IAQ parameters that do not meet the acceptance criteria.
   2. The following criteria will be used to determine acceptance:
      a. Fungal Bioaerosols - measure in relation to outdoor air, generally not higher than outdoor air, and containing indoor populations and concentrations of fungi that are considered normal and typical. Use professional judgment of testing firm.
      b. Carbon Monoxide - measure in ppm, in relation to outdoor air. Not more than 2 ppm over outdoor air levels, and less than 9 ppm.
      c. Carbon Dioxide - measure in ppm, in relation to outdoor air. Not more than 700 ppm higher than outdoor air.
      d. Methane - measure in ppm. Not more than 5 ppm.
      e. Total Volatile Organic Compounds (TVOCs) - measure in ppm as methane, or micrograms per cubic meter (µg/m3) - not more than outdoor air, and less than 5 ppm (calculated as methane) or 3,000 µg/m3.
      f. Total Particulates - measure in total particle counts per cubic foot - total particle counts generally less than one-half (1/2) of outdoor air. Particle counts broken down to small (<2.5 microns) and large (2.5 to 10 microns).
      g. Radon - less than 2 picoCuries per liter (pCi/L).
      h. Ozone - nor more than outdoor air, and less than 0.1 ppm.
      i. Formaldehyde - measure in parts per million (ppm) - less than 0.050 ppm.
      j. 4-Phenylcyclohexene(if rubber-backed products) - measure in micrograms per cubic meter (µg/m3) - not more than 6.5 µg/m3.
      k. Lead - have paint supplier or contractor provide documentation of lead-free paint.

G. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Shop drawings, product data, and samples under provisions of Section 01 3000.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is not prohibited.

1. If reuse of other existing materials or equipment is desired, submit substitution request.
2. All items called for on the drawings to be salvaged, removed and relocated shall be inventoried, removed and stored until such time as they are to be installed in their new location. The inventory list shall be given to the Owner and shall include an itemized list that includes quantities, descriptions and condition of each item. These items are considered to be in good operating condition at the time the contract is signed, and shall remain the property of Owner. These items shall be properly protected by the contractor and removed by him, complete, including all appurtenances and reinstalled in their new location in good working order with any modifications called for by the drawings.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Where other criteria are met, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the project.

2. Have longer documented life span under normal use.
3. Are made of recycled materials.
4. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.

C. Provide interchangeable components of the same manufacture for components being replaced unless noted otherwise in the contract documents.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. All substitutions shall be submitted on the Architects form as described in paragraph 3.03.

B. Product Substitution - Prior to Bid
1. No products shall be used on the project unless they are specified or have received prior approval.
2. Products to be reviewed prior to bid shall be submitted and reviewed under the provisions of this section.
3. Substitution request including all required documentation must be delivered to the Architect's office no later than ten (10) calendar days prior to the proposal date designated in the project manual. Requests submitted late will not be considered.
4. No product will be considered "as equal" to the product specified until it has been included as an allowable substitution, in a written Addendum to the project.

C. Product Substitution - Post Contract Award
1. Product substitutions are not allowed except for the following provisions:
   a. Product is required for compliance with interpretation with code compliance.
   b. Product specified is unavailable.
   c. Product proposed will provide a credit to the Owner.
      1) Contractor shall provide amount of proposed savings on the substitution request form.
   d. Product proposed will provide a substantial benefit to the Owner's schedule.
      1) Contractor shall clearly delineate the positive impact to the project schedule.
   e. Product supplier contractor default.
      1) Written documentation will be required to substantiate request.
2. Substitution request including all required documentation must be delivered to the Architect's office no later than fifteen (15) calendar days after execution of the Contract.
3. Reimbursement of Architect's costs
   a. In the event substitutions are proposed to the Architect after the Contract has been awarded, the Architect will record all time used by him and by his consultants in evaluation of each such proposed substitution.
   b. Whether or not the Architect approves a proposed substitution, the Contractor promptly upon receipt of the Architect's billing shall reimburse the Architect at the rate of two and one-half times the direct cost to the Architect and his consultants for all time spent by them in evaluating the proposed substitution.

3.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Proposed product substitution shall comply with all applicable codes. Products not conforming to codes shall be removed and replaced at Contractors expense.

B. Coordination of substitutions:
   1. Prior to each product substitution, carefully review and coordinate all aspects of each item being submitted.
   2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
   3. By submitting the substitution request form with each submittal, the contractor certifies that this coordination has been performed.

C. Substitutions:
   1. The Contract is based on the standards of quality established in the Contract Documents.
   2. Products specified by reference to standard specifications such as ASTM and similar standards do not require further approval.
   3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Architect.

D. Coordination of Materials and Installation
   1. General contractor shall install all fire protection, electrical and data wiring in conduit as high as possible and above mechanical ductwork. General contractor shall install all fire protection, electrical, data, and wiring in conduit in areas designated on the plans while coordinating structure, mechanical equipment/ductwork, lighting, building controls, and architectural systems. The proposed layout of these systems and conduit shall be reviewed with and accepted by the architect prior to installation. Systems and conduit shall group in the area designated by the construction documents in an orderly and clean installation. Final locations and conditions of these systems and conduit shall only be accepted by the architect upon review after installation.

E. Miscellaneous Materials
   1. If proposed product substitution requires additional materials or accessories for installation in the project, Contractor shall be responsible for all costs.

F. Finishes
   1. Proposed product substitution shall not decrease the selection of colors or finishes.

G. Storage and Handling
   1. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

H. Warranty
   1. Warranty of product shall not be less than that of specified product.

3.03 PRODUCT SUBSTITUTION REQUEST FORM

A. The Architect’s “Substitution Request Form” must be used for each product submitted for consideration. The form is attached following this Section.

B. The Individual or Firm requesting a substitution must document that the requested substitution is equal or superior to the specified product. Failure to provide clear, accurate, and adequate documentation will be grounds for rejection. Any re-submittal will be handled as a new request.

C. Required documentation shall consist of applicable information which would aid the Architect in making an informed decision. Include side by side product comparisons, technical data, laboratory test results, product drawings, etc. References shall include three projects, which are from one to two years old, and three projects older than five years. Provide a list of references with the owners contact name and phone number.

D. If use of the proposed product would result in changes to the design of the building, the submittal shall describe fully the changes required to the drawings or project manual. Any cost differences resulting from modifications to the drawings and project manual and the cost of making the changes shall be borne by the Product Supplier.

E. Incomplete forms shall be rejected. The decision of the Architect is final.

3.04 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.
   5. Coordinate dimensions of Owner furnished materials and equipment with drawings and specifications prior to installation to ensure proper fit in conjunction with other Contractor supplied materials and equipment.

3.05 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged in manufacturer's original container with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

G. The Architect may reject as non-complying such material and products that do not bear identification and satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

H. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.06 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

C. Store and protect products in accordance with manufacturers' instructions. Failure to comply will result in rejection of products for use on job.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

Q. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner.

R. Additional time required to secure replacements and to make repairs will not be considered by the Architect to justify an extension in the Contract Time of Completion.

END OF SECTION

CSP# 2026-08

MORE THAN ARCHITECTS

INSTRUCTIONS FOR USE OF SUBSTITUTION REQUEST FORM

STEPS

1. Substitution request **including all required documentation** must be emailed to the Project Leader at the Architects office no later than the date indicated in the specifications. Requests submitted late will not be considered. Contact information can be found on the Huckabee website bidding section under the specific project at: www.huckabee-inc.com/construction/

2. The Huckabee "Substitution Request Form" must be used for each project submitted for consideration.

3. The Individual or Firm requesting a substitution must document that the requested substitution is equal or superior to the specified product. Failure to provide clear, accurate, and adequate documentation will be grounds for rejection. Any re-submittal will be handled as a new request.

4. Required documentation shall consist of applicable information which would aid the Architect in making an informed decision. Include **side-by-side product comparisons**, technical data, laboratory test results, product drawings, etc. References shall include three projects which are from one to two years old, and three projects older than five years. Provide a list of references with the owner's contact name and telephone number.

5. If use of the proposed product would result in changes to the design of the building, the submittal shall describe fully the changes required to the drawings or specifications. Any cost differences resulting from modifications to the drawings and specifications and the cost of making the changes shall be borne by the Product Supplier.

6. **No** product will be considered "as equal" to the product specified until it has been included as an allowable substitution in a written Addendum to the project.

7. The decision of the Architect is final.

CSP# 2026-08

MORE THAN ARCHITECTS

SUBSTITUTION REQUEST FORM

Architect Project No:_____ Bid Date:_____ Date of Request:_____

Project Name: _____

SUBSTITUTION REQUEST BY:

Firm:_____

Address:_____

_____

Phone: _____

Fax: _____

We hereby request that the following Substitution be allowed in lieu of the Product specified on the above project.

ARCHITECT / ENGINEERS RESPONSE:

☐ APPROVED ☐ APPROVED AS NOTED

☐ NOT APPROVED ☐ SUBMITTED TOO LATE

☐ FAILED TO PROVIDE ADEQUATE INFORMATION

REMARKS:_____

_____

BY:_____DATE:_____

SPECIFIED PRODUCT_____ **SPECIFICATION SECTION** _____

PROPOSED PRODUCT SUBSTITUTION_____

This request includes the following: attached Technical Data, Laboratory Tests and proposed changes to the Drawings and Specifications, which the proposed Substitution will require for proper installation.

_____

_____

The Firm requesting the Substitution agrees to pay for changes to the building design, including Architectural, Engineering, and detailing costs caused by the requested Substitution. ☐ YES ☐ NO ☐ NOT APPLICABLE

What effect does the Substitution have on other trades? _____

_____

What effect does Substitution have on Construction Schedule? _____

_____

Differences between proposed Substitution and specified item? _____

_____

Manufacturer's guarantees of the proposed and specified items are: _____ Same _____ Different
(If different, explain on attachment)

The undersigned state that the function, appearance and quality are equivalent or superior to the specified item.

_____
SIGNATURE

_____ _____
TITLE DATE

Huckabee

SECTION 01 6210
SCHEDULE OF MATERIALS AND COLORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Information and procedures for color submission for color schedule.

B. Schedule of Materials and Colors for pre-selected colors.

1.02 COLOR SCHEDULE PROCEDURES - PRE-BID SELECTED

A. Contractor shall hold color samples requiring color selections until all are received. Only then shall the actual color samples be submitted to the Architect for selection. Colors samples matching color schedule shall not be submitted until field sample verifications are required.
   1. Contractor shall submit a complete transmittal letter with each related group of items. Each sample shall be properly labeled with the name of the project, contractor, manufacturer, and date of submission. Incomplete color submittals will be returned to the Contractor.
   2. The Contractor shall allow two (2) weeks after all colors are submitted for final Owner approval.

1.03 COLOR SCHEDULE PROCEDURES - POST-BID SELECTED

A. Contractor shall hold all color samples until all items requiring color selections are received. Only then shall the actual color samples be submitted to the Architect for selection.
   1. Colors are noted on the drawings, and as specified. Where colors are not specified, Architect will select color with final color schedule.
   2. Contractor shall submit a complete transmittal letter with each related group of items. Each sample shall be properly labeled with the name of the project, contractor, manufacturer, and date of submission. Incomplete color submittals will be returned to the Contractor.
   3. The Contractor shall allow five (5) weeks after all colors are submitted for final Owner approval.

1.04 COLORS AND PATTERNS

A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.

B. Verify all graphics with the Architect before proceeding. Graphics may need to be adjusted to reflect the same composition as that shown on the drawings.

1.05 SUBMITTALS

A. Field Samples
   1. Once colors are selected, and received at the job site and prior to application or installation, the Contractor shall submit one (1) sample of each item to the Architect for verification of color and pattern.
   2. The Contractor shall allow five (5) working days from date of receipt of submission for verification notification.

1.06 SCHEDULING

A. Contractor shall submit all products in a timely manner to avoid project delays for long lead time items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers listed or named in a product or system specification are those manufacturers considered capable of manufacturing products conforming to the specification requirements.

B. The “listing” or “naming” of a manufacturer does not imply “acceptance” or “approval” of any standard product of that manufacturer.

C. Products listed or named manufacturers proposed for use shall be comparable in all respects to specified make or model number designation of named products and shall meet or exceed specification requirements of type, function, color, and quality.

D. Where products are specified by naming model number and manufacturers only, the named products establish a standard of quality. Refer to individual specification sections for additional manufacturers and procedures.

2.02 MATERIALS - GENERAL

A. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for products of type indicated.
   2. Provide trim and accessories that match color and finish unless noted otherwise.
   3. Where contractor is submitting a substitution, contractor shall provide color equal to that specified. Substituted colors are not considered approved unless published in writing in Addendum prior to bid. If substituted product does not match specified color, contractor shall provide custom color as required at no additional cost to the owner.

PART 3 - EXECUTION

3.01 APPLICATION

A. Paint any vents, grilles, piping, columns, etc. the same color as the wall or graphic unless noted otherwise.

B. Unless otherwise noted, all accent paint shall terminate at an inside corner. If wall terminates at storefront, wrap paint to meet edge of storefront.

C. All exposed concrete shall be sealed.

3.02 SCHEDULE OF MATERIALS AND COLORS

A. General Notes:
   1. All paint colors are subject to last shade adjustments.
   2. The Contractor shall submit samples of all finishes for comparison and approval of colors to the items listed in the color schedule.
   3. Where multiple buildings occur in one project, all materials and finishes may not apply to all buildings. Refer to the drawings for material and finish locations.
   4. The General Contractor shall verify all colors selections and numbers and note any drawings changes that may have occurred. Notify the Architect of any discrepancies found within 14 days.
   5. Notes stating "See Drawings for Locations" refer to the Construction Documents.
   6. Where note “pending submittal” occurs, Contractor shall submit samples of the material that meets the Standards outlined in the appropriate specification for Architect’s review and selection. For materials with more than one color, texture or pattern available, Contractor shall submit the Manufacturer’s full range of colors, texture and patterns.
   7. If there is a conflict between the product, material or color specified in this Legend and the product's specification Section within the Division, notify the Architect immediately. The Schedule of Materials and Colors shall govern unless a written clarification is given.

B. See DRAWINGS for Schedule of Materials and Colors for specific product details and requirements.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

K. Administration of Warranty Phase.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

F. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural and load bearing members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Effect on work of Owner
    f. Date and time work will be executed.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
    1. Minimum of 5 years of documented experience.

B. For surveying work, employ a land surveyor registered in Texas and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Texas. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Texas.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
    1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
    2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
    3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
    1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

2. Indoors: Limit conduct of especially noisy interior work to 8 am to 5 pm.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
1. Pest Control Service: Monthly treatments.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

G. Prior to start of work, photo and/or video document all portions of the building.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, Contractor will convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section. Contractor, subcontractor, and manufacturer's representative shall be present.

C. Notify Architect seven (7) days in advance of meeting date.

D. Prepare agenda and preside at meeting:
1. Review approved submittals.
2. Review conditions of examination, preparation and installation procedures.
3. Review coordination with related work.
4. Installation schedule.

E. Record minutes and distribute copies within two days after meeting to participants, with one copies to Architect, Owner, participants, and those affected by decisions made.

F. Pre-installation meeting shall not be scheduled until approved submittals are verified by the Contractor.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 NOTIFICATION OF ARCHITECT

A. The Contractor shall notify the Architect a minimum of 48 hours prior to the covering up of any work in progress, in order for the architect to make proper field observations of the work in place. The Contractor shall place NO concrete, fill-in ditches, or cover up walls or ceilings without first contacting the Architect, as noted above and receiving approval.

3.07 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunication, and Technology): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment including those above acoustical lay-in ceilings and gypsum board/hard ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.08 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight at interior and weathertight at exterior to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.09 PROGRESS CLEANING

A. General:
   1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
   2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
   3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
   4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:
   1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
   2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of subparagraph A.1 above.
   3. Maintain the site in a neat and orderly condition at all times.

C. Structures:
   1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
   2. Weekly, and more often if necessary, sweep interior spaces clean.
      a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.
   3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.
   4. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed. Damaged floors will be removed and replaced.
      a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.10 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.11 SYSTEM STARTUP

A. Coordinate with General Commissioning Requirements per Mechanical Specifications.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify Architectand Owner 14 days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, 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.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.12 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

B. Refer to individual specification sections for more specific demonstration and training requirements.

3.13 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Division 23 for specific requirements.

3.14 FINAL CLEANING

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. The Contractor shall have initial cleaning complete prior to the Architect performing the “Punch List” walkthrough. The building shall be thoroughly (ready for occupancy) cleaned prior to the Owner acceptance (Substantial Completion) of the building.

C. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in the Article above.

D. Site:
   1. Unless otherwise specifically directed by the Architect, broom clean paved areas on the site and public paved areas adjacent to the site. Powerwash paved surfaces, as required, to remove any stains caused by construction materials, vehicles, or workers, as approved by the Architect, and at no additional cost to the Owner.
   2. Completely remove resultant debris.

E. Structures:
   1. Exterior:
      a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
      b. Remove all traces of splashed materials from adjacent surfaces.
      c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
      d. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
   2. Interior:
      a. Visually inspect all interior surfaces (floors, walls, ceilings, fixtures, furniture, appliances, and equipment) and remove all traces of soil, waste materials, smudges, and other foreign matter.
      b. Remove all traces of splashed material from adjacent surfaces.
      c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
   3. Glass: Clean inside and outside.
   4. Polished surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.

F. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean Work.

3.15 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract.

3.16 CLOSEOUT PROCEDURES

A. Project Closeout
   1. No later than 60 days prior to Project Completion, as scheduled on the Contractors Critical Path Schedule, the Contractor shall:
      a. Develop a Project Completion List for any and all tasks that remain along with a schedule for the completion of each. This list and schedule shall be written and delivered to the Owner and Architect.
      b. Provide “hands-on” training to the Owner of all major systems as identified in Section 01 7800 – Closeout Submittals

B. Substantial Completion
   1. Prior to requesting inspection by the Architect, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.
   2. No later than 30 days prior to the scheduled Substantial Completion date the Contractor shall call for a project walk through to determine if the project is substantially complete.
      a. The Contractor shall prepare and submit a list of deficiency items as required by Paragraph 9.8.2 of the General Conditions. This list shall be submitted to the Architect a minimum of 7 days prior to the scheduled walk through.
      b. The Contractor shall provide copies of the complete TAB (Commissioning) report and verification that all repairs have been made and that the systems are operational. This report and verification shall be submitted to the Architect a minimum of 7 days prior to the scheduled walk through.
      c. The Contractor shall obtain the Certificate of Occupancy from the AHJ and supply a copy to the Architect a minimum of 7 days prior to the scheduled walk through and before substantial completion will be issued.
      d. On the scheduled date of the walk through and after receipt of the deficiency list (punch list) the Architect will inspect the project to determine the status of completion.
      e. Following inspection of the work, the Architect determines that the work is not substantially complete:
         1) The Architect promptly will so notify the Contractor, in writing, giving the reasons therefore.
         2) The Contractor shall remedy the deficiencies and notify the Architect when ready for re-inspection. The Architect will make only one trip to re-inspect the project.
         3) The Architect shall be entitled to reimbursement of costs on an hourly basis for time spent to re-inspect the project. Rate for reimbursement shall be two hundred dollars per hour ($200.00/hr) including travel time and shall be charged against the Contractors retainage held for this work.
   3. When the Architect concurs that the Work is substantially complete:
      a. The Architect will prepare a "Certificate of Substantial Completion" on AIA Form G704, accompanied by the Contractor's list of items to be completed or corrected, as verified by the Architect.
      b. The Architect will submit the Certificate to the Owner and to the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

C. Final Completion
   1. Prepare and submit the notice required by the first sentence of Paragraph 9.10.1 of the General Conditions.
   2. Verify that the Work is complete including, but not necessarily limited to, the items mentioned in Paragraph 9.8.2 of the General Conditions.
   3. Certify that:
      a. Contract Documents have been reviewed;

b. Work has been inspected for compliance with the Contract Documents;
c. Work has been completed in accordance with the Contract Documents;
d. Equipment and systems have been tested as required, and are operational;
e. Work is completed and ready for final inspection.

4. The Architect will make an inspection to verify status of completion.
5. Should the Architect determine that the Work is incomplete or defective:
   a. The Architect promptly will so notify the Contractor, in writing, listing the incomplete or defective work.
   b. Remedy the deficiencies promptly, and notify the Architect when ready for re-inspection.
6. When the Architect determines that the Work is acceptable under the Contract Documents, he will request the Contractor to make closeout submittals.

D. Closeout Submittals
1. Closeout submittals as described in Section 01 7800 and Architect approval secured.
2. Refer attached Check List.
3. Contractor shall deliver all attic stock referenced in specifications. Attic stock shall be delivered to owners designated location. Contractor shall obtain a signed receipt of delivery.
4. Contractor shall obtain Certificate of Occupancy from the AHJ and submit a copy to the Architect.

E. Release of Funds
1. Retainage for the project will be held until project closeout is complete as verified by the items in paragraph above and the attached Check List including the completion of all Punch List items.
2. The Architect will estimate the cost of each item on the Punch List, withholding funds for each which shall be separate from the retainage. These funds will be released to the Contractor as items are completed and verified on the Punch List.
3. THE RETAINAGE WILL NOT BE RELEASED UNTIL CERTIFICATE OF OCCUPANCY FROM THE AHJ HAS BEEN SUBMITTED TO THE ARCHITECT.
4. THE RETAINAGE WILL NOT BE RELEASED UNTIL THE PROJECT CLOSEOUT IS COMPLETE.

F. Final adjustment of accounts
1. Submit a final statement of accounting to the Architect, showing all adjustments to the Contract Sum.
2. If so required, the Architect will prepare a final Change Order showing adjustments to the Contract Sum which were not made previously by Change Orders.

FINAL ACCEPTANCE CHECKLIST

DATE:_____

PROJECT NAME:_____

OWNER'S NAME:_____

COMPLETED BY:_____

TO:_____

COPY TO:_____

THE FOLLOWING CHECKLIST IS COMPLETED AND THEREFORE THE PROJECT IS READY FOR FINAL PAYMENT AS OUTLINED IN THE CONTRACT DOCUMENTS.

Received Final Payment Request and Release of Claims.			
Final Change Order Completed and Signed By All.			
Contractor's Affidavit of Payment of Debts and Claims.			
Consent of Surety To Final Payment.			
All Operation & Maintenance Manuals Received.			
Final Record Drawings Received.			
All Guarantees and Warranties Received.			
Punchlist Fully Cleared (Attached Copy).			
Air Quality and Commissioning Completed and All Items Addressed and Corrected.			
Written Acknowledgement of Lead and Asbestos Free.			
All Attic Stock Delivered to Owner.			
Certificate of Occupancy Obtained From AHJ			

EXPLANATION OF ANY OUTSTANDING ISSUES OR DEFICIENCIES:_____

_____

_____

HEREBY SUBMITTED FOR REVIEW:

SIGNED:_____ **DATE:**_____

3.17 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

1. Review warranty request procedures with the Architect and Owner no less than two weeks prior to Date of Substantial Completion.
2. All work performed and completed during the Contractor's one year warranty period shall be noted as complete and signed off on accordingly on a warranty request form as agreed upon by Owner and Architect. The form will be provided to the Contractor for each item requested for maintenance or repair and is required to be returned, once the work is complete, in the same originally sent document format with cause and corrective action described in detail. All work during the Contractor's one year warranty period shall be communicated by the Contractor to both the Owner and Architect.
3. Contractor shall maintain a complete and accurate schedule of the dates of Substantial Completion, dates upon which the one year warranty on each phase or building which is substantially complete will expire, and dates of Final Completion. Contractor agrees to provide notice of the warranty expiration date to Owner and Architect at least one month prior to the expiration of the one year warranty period on each building or each phase of the building, which has been substantially completed. Prior to termination of the one year warranty period, Contractor shall accompany the Owner and Architect on review of the building and be responsible for correcting any reasonable deficiencies not caused by the Owner or by the use of the building which are observed or reported during the review. For extended warranties required by various sections, i.e. roofing, compressors, mechanical equipment, Owner will notify the Contractor of deficiencies and Contractor shall start remedying these defects within three (3) days of initial notification from Owner. Contractor shall prosecute the work without interruption until accepted by the Owner and the Architect, even though such prosecution should extend beyond the limit of the warranty period.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for digital project records.

B. Project Record Documents.

C. Operation and Maintenance Data.

D. Closeout Documents.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Section 01 7900 - Demonstration and Training: Training requirements.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

F. Individual Product Sections: Specific requirements for demonstration and training.

1.03 SUBMITTALS

A. Submittal Procedure

1. Within sixty (60) days following the Notice to Proceed, the Contractor shall submit a list of Expected Closeout Documents for review by the Architect. This list shall include project record documents, operation and maintenance data, warranties, bonds, contract forms, health/safe environment data, attic stock sign offs, Owner training, certifications and inspections, and other types as indicated. All items on the list shall be titled with spec section number and general description - Example: "09 3000 Tiling - 1 year warranty".
2. The Architect will review the list of Expected Closeout Documents, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised list to the Architect and Owner within fourteen (14) business days and thereafter until approved.
3. Contractor may submit Closeout Documents by Specification Division in full as scopes of work are completed.
4. Within sixty (60) calendar days of substantial completion, Contractor shall submit closeout submittals as required in accordance with this section and secure Architect’s approval.
5. Contractor shall provide cover page with space for Contractor and Architect review stamps for each submission.
6. The Architect's approval of the current status of Project Record Documents may be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.
7. Prior to submitting each request for progress payment, secure the Architect's approval of the current status of the Project Record Documents.
8. Prior to submitting request for final payment, Contractor shall submit the final Project Record Documents to the Architect and secure approval.
9. Contractor shall submit a complete set of closeout documents for each project where multiple projects are combined under a single proposal package.
10. Review and Final Submission of Closeout Submittals
    a. Participate in review meetings as required.
    b. Documents shall be reviewed and verified by contractor prior to submission to the Architect.

c. Review submittal with Owner and Architect prior to final submittal for review and electronic archiving.
d. Number shall be Architects project number followed by the appropriate specification section - consecutive submittal number for section.
(Example - 1234-01-01 Tiling 09 3000 - 5)
When material is re-submitted for any reason, transmit under a new letter of transmittal and with a new transmittal number. On re-submittals, cite the original submittal number for reference.
e. Contractor shall allow 14 days from date of submission for Preliminary Architectural Review excluding delivery time to and from the Contractor.
f. The contractor shall be responsible for delays caused by rejection of inadequate or incorrect submittals.
g. Submittals received by Architect without General Contractor's stamp will be rejected.
h. Make changes required from the Preliminary Architectural Review and deliver the Final Project Record Documents to and secure approval from the Architect. When revised for resubmission, identify all changes made since previous submission.
i. Contractor will pay all associated cost in preparing close-out documents.

11. Closeout Submittals Requirements.
a. Closeout and Record Documents as required by this section shall be provided to the Owner upon completion of the project. Submit the number as outlined below:
1) Project Record Documents - Drawings and Project Manual
(a) One (1) copy on USB Flash Drive
2) Closeout Documents – Including Operation and Maintenance Manuals
(a) One (1) copy on USB Flash Drive
b. Electronic Submittal Format.
1) The digital file shall be set up using a non-proprietary “PDF” format.
2) All data shall be indexed/book marked and hyperlinked to associated data.
3) Data shall be searchable by key word. All data shall allow printing of material.
4) Electronic submittal shall follow the format shown in Part 3.
5) Under paragraph 3.05 Assembly of Operations and Maintenance Manuals, all items shall be organized as specified.
c. Training Session Submittal Format.
1) Refer to Section 01 7900 - Demonstration and Training.

B. Project Record Documents: Submit documents to and secure approval from Architect prior to request for final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. All record documents shall be maintained on site in digital format; record actual revisions to the Work, including but no limited to:
1. Drawings.
2. Specifications.
3. Addenda.
4. RFIs.
5. Change Orders and other modifications to the Contract.
6. Reviewed shop drawings, product data, and samples.
7. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Contractor shall maintain and protect the record documents with backups and/or any other means necessary to ensure the integrity of the digital files.

D. In the event of loss of recorded data, use means necessary to again secure the data to the Architect's approval.
   1. Such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials.
   2. In such case, provide replacements to the standards originally required by the Contract Documents.

E. Record information concurrent with construction progress. Record Documents shall be current and submitted with each pay application.

F. Specifications: Record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

G. Record Drawings and Shop Drawings: Mark each item to record actual construction including:
   1. On the cover sheet of the Project Manual and the Drawings, provide the following statement, “RECORD DOCUMENTS- The changes noted herein are indicated in color and are designated by a revision delta (RD). The changes are recorded by [Contractor Name], [Date].”
   2. Prior to construction, insert all addenda to the record documents, both drawings and specifications as modified.
   3. Making entries on Drawings.
      a. Using colored markings, clearly describe the change by graphic line and note as required.
      b. Date all entries.
      c. Call attention to the entry by a "cloud" drawn around the area or areas affected. Add delta triangle with the letters “RD” inside the triangle.
      d. In the event of overlapping changes, use different colors for the overlapping changes.
   4. In addition to field changes, mark the record documents with areas modified by RFIs and change orders and hyperlink to the corresponding data.
   5. Schematic layouts.
      a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, are shown schematically and is not intended to portray precise physical layout.
      b. Clearly identify the item by accurate note such as "cast iron drain," "copper water", and the like.
         1) Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum," "exposed," and the like).
         2) Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
   6. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   7. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   8. Field changes of dimension and detail.
   9. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. Refer to Divisions 21, 22, 23, 26, 27 and 28 for system requirements.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into organized file folders for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate folder for each system.

C. Cover: Identify each USB Flash Drive with the title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractor and subcontractors, with names of responsible parties organized by division with project scopes listed for each company.

E. Tables of Contents: List every item using the same identification as on the content section and hyperlinked accordingly; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

F. Contents: Prepare final project record closeout documents for delivery to Owner in PDF file format as follows:
   1. FILE FOLDER: XXXX-XX OWNER'S NAME - PROJECT NAME - CLOSEOUT SUBMITTAL
      a. FILE FOLDER: 01 Table of Contents
         1) PDF File: Table of Contents
      b. FILE FOLDER: 02 Project Directory
         1) PDF File: Project Directory (organized as below):
            (a) Design Team
            (b) General Contractor
            (c) Sub-Contractors and Principal Vendors (organized by Division with project scope(s) listed for each Company)
      c. FILE FOLDER: 03 Contract Forms (organized and titled as below):

1) PDF FILE: Substantial Completion, AIA G704
2) PDF FILE: Payment and Performance Bond
3) PDF FILE: Certificates of Liability Insurance
4) PDF FILE: Contractor's Affidavit of Payment of Debts and Claims, AIA G706
5) PDF FILE: Contractor's Affidavit of Release of Liens, AIA G706A
6) PDF FILE: Consent of Surety to Final Payment, AIA G707
7) PDF FILE: Contractor and Sub-contractors' Release or Waiver of Liens
8) FILE FOLDER: Change Orders
   (a) PDF FILES: (separate files for each Change Order, organized and titled in numerical order)

d. FILE FOLDER: 04 Certifications and Inspections (organized and titled as below):
1) PDF FILE: The correspondence from the Geotechnical Engineer, required by Section 01 1400 at the beginning of construction, indicating that the Construction Documents conform with their recommendations.
2) PDF FILE: The correspondence from the Special Inspection and Testing Agency (SITA), required by Section 01 1400 at the beginning of construction, indicating that the SITA accepted the responsibility to perform the specified SITA scope and meet the specified SITA qualifications
3) PDF FILE: The correspondence from the Commissioning Agent (CxA), required by Section 01 1400 at the beginning of construction, indicating that the CxA accepted the responsibility to perform the specified SITA scope and meet the specified SITA qualifications
4) PDF FILE: The "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control" required by Section 01 4533 at the beginning of construction.
5) PDF FILE: A copy of the written correspondence from the Contractor to the AHJ submitting the "Final Reports of Quality Control" required by Section 01 4533 from the SITA, CxA, and Code-Required Structural Observer. The copy of this correspondence shall include the actual reports and not just be a cover letter.
6) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the SITA
7) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the CxA
8) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Code-Required Structural Observer
9) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Structural Engineer
10) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Mechanical Engineer
11) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Electrical Engineer
12) PDF FILE: Certificates of Occupancy
13) PDF FILE: TEA Certificate of Project Compliance. File may be downloaded at https://tea.texas.gov/sites/default/files/cert_pre2004.pdf. Sample form is attached following this Section.
14) PDF FILE: Final Fire Inspection
15) PDF FILE: Final Health Inspection
16) PDF FILE: Final Elevator Inspection
17) PDF FILE: Final Building Inspection
18) PDF FILE: Accessibility Review Report
19) PDF FILE: Energy Code Compliance Letter
20) PDF FILE: HVAC Test and Balance Reports

21) PDF FILE: Backflow Test Report
22) PDF FILE: Data Testing Results
23) FLW FILE: Data Testing Results (Native)

e. FILE FOLDER: 05 Health/Safe Environment Data (organized and titled as below):
1) PDF FILE: Asbestos-, Lead- and Hazardous-Free Material Certificates or Letter
2) PDF FILE: Material Safety Data Sheets (MSDS) (organized by Division)
3) PDF FILE: Indoor Air Quality Test Reports

f. FILE FOLDER: 06 Additional Project Information
1) FILE FOLDER: Requests for Information
(a) PDF FILES (separate files for each RFI, organized and titled in numerical order)
2) FILE FOLDER: Requests for Proposals
(a) PDF FILES (separate files for each RFP, organized and titled in numerical order)
3) FILE FOLDER: Approved Submittals
(a) PDF FILES (separate files for each Submittal, organized and titled in numerical order by specification section)

g. FILE FOLDER: 07 Attic Stock
1) PDF FILES: Attic Stock Sign-Off Sheets (separate files for each, showing Owner receipt, and organized and titled in numerical order by Specification Section)

h. FILE FOLDER: 08 Demonstration and Training
1) FILE FOLDER: Sign-In Sheets
(a) PDF FILES: (separate files for each, organized and titled in numerical order by Specification Section)
2) FILE FOLDER: Training Videos
(a) All training videos organized and titled in numerical order by Specification Section

i. FILE FOLDER: 09 Project Record Documents
1) PDF FILE: Project Record Specifications Manual (organized and bookmarked by Division and by Specification Section) - include and hyperlink all Addenda, RFIs, RFPs, and In-Field Changes stamped as "As-Built" or "Record Documents".
2) PDF FILE: Project Record As-Built Drawings (organized and bookmarked by Sheet Number) - include and hyperlink all Addenda, RFIs, RFPs, and In-Field Changes stamped as "As-Built" or "Record Documents".

j. FILE FOLDER: 10 Warranties
1) FILE FOLDERS: (separate file folders, organized and titled by Division)
(a) PDF FILES: (all warranty PDF files organized under each Division file folder and titled by Company Name)
(b) PDF FILE: List of all warranties extending past one year. Include company name and contact information.

k. FILE FOLDER: 11 Operation and Maintenance Manuals
1) PDF FILE: Keying Schedule
2) PDF FILE: Shop Drawings (separate files for each, organized and titled by Specification Section)
3) FILE FOLDER: Manuals
(a) FILE FOLDERS: (separate file folders, organized and titled by Division)
(b) PDF FILES: (all Manuals PDF files organized under each Division file folder and titled by Specification Section and scope)

3.06 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

3.07 CERTIFICATION OF PROJECT COMPLIANCE

CERTIFICATION OF PROJECT COMPLIANCE	Completion of this form is required under provisions of 61.1036(c)(3)(F) TAC for all public school district construction projects.

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 that the educational program and educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

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 facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, July 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and requiring routine maintenance where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Audio and Visual systems.
   7. Lighting systems.
   8. Security systems and Access Controls.
   9. Fire Alarm systems.
   10. Kitchen Equipment.
   11. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Architect and Humble ISD.
   2. Submittals indicated as "Draft" are intended for the use of Owner in preparation of overall Training Plan; submit in editable electronic format, latest version of Microsoft Word required.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
   4. Include Humble ISD's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.
   3. Provide sign-off sheets in the closeout documents indicating the individuals who were in attendance at each of the training sessions.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Humble ISD.

D. Provide training in minimum two hour segments.

E. The Humble ISD is responsible for determining that the training was satisfactorily completed.

F. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

H. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

J. Contractor must have written approval from the Owner and Architect to forgo any required trainings.

END OF SECTION

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements, furniture and equipment for alterations purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

B. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction including deep foundation elements remaining.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove allother paving and curbs within construction limits indicated on drawings.

B. Remove portions of existing concrete slabs as indicated on drawings.

C. Remove portions of existing walls as indicated on the drawings.

D. Remove portions of existing ceilings as indicated on the drawings.

E. Remove fences and gates.

F. Remove other items indicated, for salvage, relocation, and recycling.

G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Comply with applicable requirements of NFPA 241.
3. Use of explosives is not permitted.
4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Prior to submitting proposal, Contractor shall request a list from the Owner stating items which shall be removed by the Owner prior to demolition.

E. Included with the demolition proposal, Contractor shall provide a written declaration of items that will be salvaged from the site. Each item shall be itemized and a monetary value assigned. Credit value of salvaged items shall be included in calculation of proposal. Declaration shall be reviewed by the Owner to determine that the declaration complies with state requirements and local Board policy in regards to disposing of public property.

F. All items called for on the drawings to be salvaged, removed and relocated shall be inventoried, removed and stored until such time as they are to be installed in their new location. The inventory list shall be given to the Owner and shall include an itemized list that includes quantities, descriptions and condition of each item. These items are considered to be in good operating condition at the time the contract is signed, and shall remain the property of Owner. These items shall be properly protected by the contractor and removed by him, complete, including all appurtenances and reinstalled in their new location in good working order with any modifications called for by the drawings.

G. All items noted on the drawings to be removed and delivered to the Owner shall be cataloged with a written description and delivered to Owner at a location designated by the Owner.

H. Do not begin removal until built elements to be salvaged or relocated have been removed.

I. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

J. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

K. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

L. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

M. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Unused underground piping may be abandoned in place provided it is completely drained and capped; remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on existing record documents and field observation.
   1. Verify that construction, salvage items and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipmentas indicated on the drawings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 02 4119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

B. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

C. Related Requirements:
   1. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
   2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.03 DEFINITIONS

D. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

E. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner for reuse.

F. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

G. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

H. Unless otherwise indicated, demolition waste becomes property of Contractor.

I. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

J. Pre-demolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.
   6. If needed, insert list of conference participants not mentioned in Section 013100 "Project Management and Coordination."

1.06 INFORMATIONAL SUBMITTALS

K. Qualification Data: For refrigerant recovery technician.

L. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

M. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

N. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

O. Pre-demolition Photographs or Video: Submit before Work begins.

P. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

Q. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.07 CLOSEOUT SUBMITTALS

R. Inventory: Submit a list of items that have been removed and salvaged.

S. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.08 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.09 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Retain subparagraph below if hazardous materials are known to be present. Delete if Owner does not have, or will not provide, material safety data sheets for these materials.
4. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

G. Storage or sale of removed items or materials on-site is not permitted.

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.01 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.
1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly comply with requirements in Section 017419 "Construction Waste Management and Disposal.

B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 013591 "Historic Treatment Procedures."

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   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. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings. Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Coordinate first subparagraph below with use of elevators, stairs, or building entries permitted by building manager.
4. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
5. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will be 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: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.08 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items to Be Removed: See construction drawings.

B. Existing Items to Be Removed and Salvaged: See construction drawings.

C. Existing Items to Be Removed and Reinstalled: See construction drawings.

D. "Existing Items to Remain" Paragraph below may be used to inform Contractor of items that are to remain, such as those that occur in, or are adjacent to, construction being demolished, but are not being removed and reinstalled. Retain paragraph if required.

E. Existing Items to Remain: See construction drawings.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

D. Section 05 2100 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.

E. Section 05 3100 - Steel Decking: Placement of steel anchors in composite decking.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary 2019 (Reapproved 2022).

B. ACI PRC-347 - Guide to Formwork for Concrete 2014 (Reapproved 2021).

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

D. ACI SPEC-301 - Specifications for Concrete Construction 2020.

E. 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).

F. PS 1 - Structural Plywood 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.

2. Products:

a. Nox-Crete Inc; BIO-NOX: www.nox-crete.com/#sle.

b. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.

c. W. R. Meadows, Inc; Duogard II (water-based): www.wrmeadows.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

1. Products:

a. BoMetals, Inc: www.bometals.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Obtain approval before framing openings in structural members that are not indicated on drawings.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 1000

SECTION 03 1114
PROTECTION OF UNDER-SLAB PLUMBING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the Concrete Subcontractor's work to be included in this section is as follows:

1. After the Plumber marks the plan locations of plumbing on the site, the Concrete Subcontractor shall excavate the subgrade and install retaining structures, decking that spans over retaining structures, and voidforms to isolate all new under-slab plumbing, hangers and supports from the subgrade under new slab-on-voidform areas.

2. Construction by the Concrete Subcontractor of an accessible concrete vault outside of the building footprint that contains flexible expansion joints in all new under-slab plumbing where the plumbing transitions between isolated conditions under new slab-on-voidform areas to soil-supported conditions at the perimeter of slab-on-voidform areas.

B. This section shall apply to all sanitary sewer plumbing under slab-on-voidform areas. This section does not apply to plumbing under crawlspace areas which will be accessible by occupants after completion of the construction, where the Owner can access the crawlspace and perform maintenance as needed if plumbing is damaged by expansive soil movement.

C. If there is a conflict between other specification sections and this section, or between any construction drawings and this section, this section shall govern with regard to the protection of under-slab plumbing.

D. The Contractor shall be permitted to, at the Contractor's option, either install the plumbing before the slab is poured by using the PATENT-PENDING MudskipperTM System or install the plumbing after the slab is poured by accessing the under-slab space, removing all voidforms and excavating as required so as to epoxy anchor threaded hanger rods to the under-side of the slab and create the voidspace required. The Basis of Design is the MudskipperTM System. PlumbingVoid as manufactured by VoidForm shall not be permitted. PipeVoid or Utility Protection System as manufactured by SuperVoid shall not be permitted.

1.02 QUALITY ASSURANCE

A. Refer to Section 22 0531.

1.03 SUBMITTALS

A. Refer to Section 22 0531.

1.04 RELATED SECTIONS

A. Refer to Section 22 0531.

PART 2 – PRODUCTS

2.01 RELATED PATENT-PENDING MUDSKIPPERTM SYSTEM PRODUCTS TO BE PURCHASED, FABRICATED AND/OR INSTALLED BY THE CONCRETE SUBCONTRACTOR, NOT THE PLUMBER. IF THE CONTRACTOR CHOOSES TO INSTALL MUDSKIPPERTM SYSTEM PRODUCTS, THE CONCRETE SUBCONTRACTOR SHALL INSTALL THE FOLLOWING ITEMS:

A. MudskipperTM Walls: Earth-formed, gravity retaining walls to retain soil for plumbing trenches to be installed on-site by Concrete Subcontractor with unreinforced, flowable concrete fill; 1:1 horizontal to vertical aspect ratio except where interrupted by foundation elements (piers and gradebeams; bottom of MudskipperTM Walls to be at the same elevation as the bottom of the excavated plumbing trench; maximum depth of 34 inches unless otherwise approved; flowable concrete fill with fine aggregate but no coarse aggregate; minimum 110 pcf unit weight; minimum specified compressive strength of 1,200 psi at 28 days; material to be purchased from a concrete supplier.

B. Degradable MudskipperTM Decking: American Plywood Association (APA) Rated Sheathing; 19/32” thickness; Performance Category Span Rating: 40/20; Exposure 1 Bond Classification (not permitted to be “C-C” Bond Classification or “Exterior” rated sheathing); as manufactured/distributed by:

1. VoidForm® Products, Inc.; www.voidform.com; phone: 888-704-8643

2. Other manufacturers are permitted only if licensed by Mudskipper, LLC; www.mudskippersystem.com; email: info@mudskippersystem.com

3. Substitutions that the Contractor believes to be equal or better must be submitted and approved before proposals are submitted. However, substitutions which would constitute infringement on the intellectual property rights of the inventor of the MudskipperTM System will not be permitted.

C. MudskipperTM Decking Supports: 12 gage 1.625” x 1.625” strut channels with slotted holes in the webs; to bear on MudskipperTM Walls (in a seat that is created by the Concrete Subontractor with a grinder) so as to provide support for MudskipperTM Decking where plumbing lines interrupt MudskipperTM Walls; oriented with the open side at the bottom; it shall not be permitted to attach decking to walls; it shall be permitted to attach MudskipperTM Decking material to decking supports; finishes permitted: ungalvanized and unpainted steel, galvanized steel, or painted steel; as distributed by:

1. VoidForm® Products, Inc.; www.voidform.com; phone: 888-704-8643

2. Other manufacturers are permitted only if licensed by Mudskipper, LLC; www.mudskippersystem.com; email: info@mudskippersystem.com

3. Substitutions that the Contractor believes to be equal or better must be submitted and approved before proposals are submitted. However, substitutions which would constitute infringement on the intellectual property rights of the inventor of the MudskipperTM System will not be permitted.

D. MudskipperTM Vaults: Refer to the Structural Drawings for concrete cast-in-place vaults outside of the building footprint that provide a space for a flexible expansion joint transition with a vertically-slotted opening for MudskipperTM Tails.

2.02 PATENT-PENDING MUDSKIPPERTM SYSTEM PRODUCTS TO BE INSTALLED BY THE PLUMBER. IF THE CONTRACTOR CHOOSES TO INSTALL MUDSKIPPERTM SYSTEM PRODUCTS, THE CONCRETE SUBCONTRACTOR SHALL PURCHASE THE FOLLOWING WITH VOIDFORMS AND INCLUDE THE COST OF THIS PURCHASE IN THE CONCRETE SUBCONTRACTOR'S BID (NOT TO BE INCLUDED IN THE PLUMBING SUBCONTRACTOR'S BID) BUT, DURING CONSTRUCTION, THE CONCRETE SUBCONTRACTOR SHALL PROVIDE THESE TO THE PLUMBER ON-SITE AND THE PLUMBER SHALL INSTALL THEM:

A. MudskipperTM Stakes to Remain in the Subgrade Permanently: Refer to Section 22 0531.

B. Re-Usable MudskipperTM Rods and Rod Accessories: Refer to Section 22 0531.

C. MudskipperTM Framing to be Field-Cut and Wire Welded Together by Plumber On-Site and Cast Permanently into the Concrete Slab, and Framing Accessories: Refer to Section 22 0531.

D. MudskipperTM Clamps: Refer to Section 22 0531.

E. MudskipperTM Tails: Refer to Section 22 0531.

F. MudskipperTM Retainer Boards: Refer to Section 22 0531.

G. MudskipperTM Plug Material: Refer to Section 22 0531.

2.03 VAPOR BARRIER MATERIAL AT THREADED ROD HANGER PENETRATIONS: FLEXIBLE AND MOLDABLE BLEND OF SYNTHETIC RUBBER AND RESINS TO BE VERIFIED AS COMPATIBLE WITH THE SPECIFIED VAPOR BARRIER SYSTEM BEFORE PURCHASING MATERIALS; AS MANUFACTURED/DISTRIBUTED BY:

A. StegoTack® Tape by Stego Industries; www.stegoindustries.com; phone: 877-464-7834

B. Other manufacturers are permitted only if licensed by Mudskipper, LLC; www.mudskippersystem.com; email: info@mudskippersystem.com

C. Substitutions that the Contractor believes to be equal or better must be submitted and approved before proposals are submitted.

PART 3 – EXECUTION

3.01 INSTALLATION OF MUDSKIPPERTM WALLS: AFTER GENERAL CUT AND FILL OPERATIONS HAVE BEEN PERFORMED TO CREATE A LEVEL PAD UNDER THE BUILDING AREAS, BUT BEFORE INSTALLATION OF PIERS AND GRADEBEAMS, CONCRETE SUBCONTRACTOR SHALL INSTALL EARTH-FORMED MUDSKIPPERTM WALLS. IT SHALL BE PERMITTED TO PHASE THIS CONSTRUCTION WHERE WALLS ARE INSTALLED BEFORE PIERS IN AREAS DETERMINED BY THE CONTRACTOR. REFER TO THE CONSTRUCTION DOCUMENTS FOR LOCATIONS AND DETAILS OF MUDSKIPPERTM WALLS.

A. When the Concrete Subcontractor requests, the Plumber shall mark the plan locations on-site of plumbing lines that will be installed between Mudskipper Walls and intersecting plumbing lines that will interrupt Mudskipper Walls, and mark the locations where flow lines occur that will require transition in Mudskipper Wall depths to provide the required voidspace underneath utilities.

B. Concrete Subcontractor shall install the walls based on the locations marked by the Plumber.

C. Concrete Subcontractor shall not excavate soil between Mudskipper Walls until it is no longer necessary for equipment to drive over or within 3 feet of Mudskipper Walls, which will generally be after piers and gradebeams have been installed in an area.

D. No curing compound or other curing methods are required for the Mudskipper Walls, which are utility walls that will be under the slab in unaccessible areas.

3.02 INSTALLATION OF PIERS, PIER CAPS AND GRADEBEAMS: AFTER INSTALLATION OF MUDSKIPPER WALLS, PIERS AND GRADEBEAMS SHALL BE INSTALLED, DRIVING EQUIPMENT OVER THE MUDSKIPPER WALLS SHALL NOT BE PERMITTED UNTIL AT LEAST 2 DAYS AFTER THE MUDSKIPPER WALLS HAVE BEEN POURED.

3.03 EXCAVATION FOR PLUMBING TRENCHES: WHEN THE CONCRETE SUBCONTRACTOR REQUESTS, THE PLUMBER SHALL MARK THE PLAN LOCATIONS ON-SITE OF PLUMBING LINES THAT WILL BE INSTALLED WITHOUT MUDSKIPPER WALLS FLANKING THE PLUMBING. CONCRETE SUBCONTRACTOR SHALL THEN EXCAVATE AS REQUIRED BY SECTION 22 0531 (ACCORDING TO THE INITIAL MUDSKIPPER PLAN SUBMITTAL).

3.04 INSTALLATION BY PLUMBER OF TEMPORARY PLUMBING SUPPORTS AND PLUMBING: AFTER EXCAVATION BY THE CONCRETE SUBCONTRACTOR, THE PLUMBER SHALL INSTALL MUDSKIPPER STAKES AND RODS AND FRAMING, AND INSTALL PIPE HANGES, CLEVIS HANGES AND PLUMBING, AND THE PLUMBING SHALL BE INSPECTED AND APPROVED BY THE AUTHORITY HAVING JURISDICTION (AHJ).

3.05 INSTALLATION OF VOIDFORM FORMWORK:

A. Grading Verification: Concrete Subcontractor shall verify that grades under main slab-on-void areas will allow top of Mudskipper Decking immediately under the slab to be at the specified elevation of the bottom of the slab. This will require approximately 1/2" more concrete under the slab where Mudskipper Decking is not installed immediately under the slab and the Concrete Subcontrator shall account for this extra concrete in their bid.

B. Installation of Mudskipper Decking over Mudskipper Walls: After approval by the AHJ, the Concrete Subcontractor shall install Mudskipper Decking to span in the strong direction (parallel to the originally long dimension of an 8' x 4' sheet of plywood) over Mudskipper Walls so as to provide means of support for carton voidboxes. Ends of Mudskipper walls shall be formed with plywood, wood or steel where the ends are near foundation elements and where the ends create a gap for intersecting plumbing that interrupts the Mudskipper Walls. It shall be permitted for Mudskipper Decking to be installed and receive rain during construction before carton voidboxes are installed. It shall not be permitted to attach Mudskipper Decking to Mudskipper Walls. Install Mudskipper Decking Supports between Mudskipper Walls where pluming interrupts Mudskipper Walls. Provide 1" expansion joint material as a separation between Mudskipper walls and any adjacent foundation elements (e.g. piers and/or gradebeams).

C. Installation of Carton Void Boxes: Carton Void Boxes shall be installed as specified.

D. Installation of Masonite over Carton Void Boxes: Install 1/4" Masonite over carton voidboxes as specified.

E. Installation of Mudskipper Decking over Masonite: After Masonite is installed, Concrete Subcontractor shall install Mudskipper Decking over gaps in the void formwork created by the plumbing.

3.06 INSTALLATION OF SLAB COMPONENTS BEFORE POURING CONCRETE:

A. Initial Installation of Vapor Barrier and Accessories: Concrete Subcontractor shall install vapor barrier as specified, installing StegoTack Tape or equal around each hanger rod penetration. The Concrete Subcontractor shall not be required to install StegoTack Tape around the temporary Mudskipper Rods. Where clevis hangers extend up into the bottom of the slab at unique plan locations, Concrete Subcontractor shall warp vapor barrier up and over Clevis hangers.

B. Installation of Reinforcing Bars and Accessories: Concrete Subcontractor shall install reinforcement as specified by the Structural Engineer. Bars shall be supported over vapor barrier over decking with supports that are shorter, to accommodate for the difference in height. Top bars shall be supported within 6 inches in all 4 directions of any pipe hanger and any Mudskipper Rod. These bar supports will be in addition to typical bar supports and the Concrete Subcontractor shall include these additional supports in their bid.

C. Tying of Mudskipper Framing to Reinforcing Bars: The Plumber shall verify that sufficient bar supports have been installed by the Concrete Subcontractor and then the Plumber shall tie Mudskipper Framing to perpendicular bars to stabilize the Mudskipper Framing and then the Plumber shall remove the Mudskipper Rods and Temporary Support Nut.

D. Repair of Vapor Barrier: After the Plumber removes the Mudskipper Rods, the Concrete Subcontractor shall repair the hole in the vapor barrier in accordance with specifications.

E. Quality Control by the Plumber: Before concrete is poured, the Concrete Subcontractor shall verify that the Plumber has provided the Contractor with a video recording of camera evidence that the Plumber has verified the flow lines of the plumbing are acceptable, as specified in Section 22 0531.

3.07 POURING THE CONCRETE SLAB: ONLY AFTER THE CONCRETE SUBCONTRACTOR HAS PROVIDED THE CONTRACTOR WITH A VIDEO RECORDING OF CAMERA EVIDENCE THAT THE PLUMBER HAS VERIFIED THE FLOW LINES OF THE PLUMBING ARE ACCEPTABLE, THE CONCRETE SUBCONTRACTOR SHALL POUR THE CONCRETE FOR THE SLAB.

3.08 POST-SLAB QUALITY CONTROL: AT LEAST 3 DAYS AFTER THE CONCRETE SLAB HAS BEEN POURED, THE CONCRETE SUBCONTRACTOR SHALL VERIFY THAT THE PLUMBER HAS PROVIDED THE CONTRACTOR WITH VIDEO EVIDENCE THAT THE FLOW LINES OF THE PLUMBING ARE ACCEPTABLE.

END OF SECTION 03 1114

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 31 6329 - Drilled Concrete Piers and Shafts: Reinforcement for drilled pier foundations.

1.03 REFERENCE STANDARDS

A. ACI MNL-66 - ACI Detailing Manual 2020.

B. ACI SPEC-301 - Specifications for Concrete Construction 2020.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

D. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement 2019, with Editorial Revision.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.

F. CRSI (DA4) - Manual of Standard Practice 2018, with Errata (2019).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301.

1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel Mat: ASTM A704/A704M, using ASTM A615/A615M, Grade 40 (40,000 psi) steel bars or rods, unfinished.

C. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

D. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. (Heavy duty chairs for slab on grade).

3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars.

1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.

2. Products:

a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com.

b. Splice Sleeve North America, Inc; NMB Splice Sleeve System: www.splicesleeve.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for splicing reinforcing bars.

1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.

2. Products:

a. Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-in: www.daytonsuperior.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.

1. Products:

    a. Dayton Superior Corporation; A58 sure Plug: www.daytonsuperior.com.

    b. Substitutions: See Section 01 6000 - Product Requirements.

D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

1. Products:

    a. Dayton Superior Corporation; Sleeve-Lock Grout: www.daytonsuperior.com.

    b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

1. Review locations of splices with Architect.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as indicated on drawings.

E. Bond and ground all reinforcement to requirements of Section 26 0526.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

3.03 SCHEDULES - SEE DRAWINGS

END OF SECTION 03 2000

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete for composite floor construction.

B. Floors and slabs on grade.

C. Concrete foundation walls.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

F. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

D. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction 2015.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

E. ACI PRC-305 - Guide to Hot Weather Concreting 2020.

F. ACI PRC-306 - Guide to Cold Weather Concreting 2016.

G. ACI PRC-308 - Guide to External Curing of Concrete 2016.

H. ACI SPEC-301 - Specifications for Concrete Construction 2020.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.

L. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

N. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

O. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

P. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

Q. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).

R. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2023, with Editorial Revision.

S. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.

T. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

U. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2021.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.

W. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

X. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

Y. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.

Z. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric) 2014.

AA. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.

BB. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.

F. Test Reports: Submit report for each test or series of tests specified.

G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C or F.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

1. Products:

a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

3. Products:

a. Henry Company; Moistop Ultra 15: www.henry.com.

b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com.

c. Poly-America; Husky Yellow Guard Class A 15-mil Vapor Barrier: www.yellowguard.com.

d. Stego Industries, LLC; 15 mil: www.stegoindustries.com.

e. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.

f. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

a. Maximum: Plus 4 percent.

b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 5000 pounds per square inch.

4. Flowable Products:

a. Euclid Chemical Company; NS GROUT: www.euclidchemical.com.

b. Five Star Products, Inc; Five Star Fluid Grout 100: www.fivestarproducts.com.

c. Kaufman Products Inc; SureGrout: www.kaufmanproducts.net.

d. Substitutions: See Section 01 6000 - Product Requirements.

5. Low-Slump, Dry Pack Products:

a. Euclid Chemical Company; DRY PACK GROUT: www.euclidchemical.com.

b. Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com.

c. SpecChem, LLC; SC Multipurpose Grout: www.specchemllc.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

1. Products:

a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com.

b. Kaufman Products Inc; SureBond: www.kaufmanproducts.net.

c. Kaufman Products Inc; SureWeld: www.kaufmanproducts.net.

d. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com.

e. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com.

B. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.

2. Products:

a. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com.

b. Dayton Superior Corporation; Slow Set Bonding Agent: www.daytonsuperior.com.

c. Kaufman Products Inc; SurePoxy HM EPL: www.kaufmanproducts.net.

d. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: www.specchemllc.com.

e. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com.

f. Substitutions: See Section 01 6000 - Product Requirements.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2. Products:

a. Nomaco, Inc; Nomaflex Expansion Joint Filler with Void Cap Option: www.nomaco.com.

b. W. R. Meadows, Inc; Fiber Expansion Joint Filler with Snap-Cap: www.wrmeadows.com.

c. Substitutions: See Section 01 6000 - Product Requirements.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

E. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

1. Manufacturers:

a. BoMetals, Inc; QuicDowel: www.bometals.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

1. Product dissipates within 4 to 6 weeks.
2. Provide product containing fugitive red dye.
3. Products:
   a. Dayton Superior Corporation; Resin Cure with Dye J11WD: www.daytonsuperior.com.
   b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com.
   c. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net.
   d. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
   2. Water-Cement Ratio: Maximum as indicated on drawings percent by weight.
   3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   4. Maximum Slump: 4 inches.
   5. Maximum Aggregate Size: 5/8 inch.

E. Structural Lightweight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
   2. Water-Cement Ratio: Maximum 40 percent by weight.

3. Total Air Content: 3 percent, determined in accordance with ASTM C173/C173M.

4. Maximum Slump: 3 inches.

5. Maximum Aggregate Size: 5/8 inch.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

2. Use latex bonding agent only for non-load-bearing applications.

D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

E. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.

2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.

3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.

4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

b. Spraying: Spray water over floor slab areas and maintain wet.

3. Final Curing: Begin after initial curing but before surface is dry.

a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.11 SCHEDULE - CONCRETE TYPES AND FINISHES - SEE DRAWINGS.

END OF SECTION 03 3000

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Final cleaning of masonry surfaces.

B. Replacement of masonry units.

C. Repointing mortar joints.

D. Repair of damaged masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Masonry Mortaring and Grouting.

B. Section 04 2000 - Unit Masonry: Brick and Block masonry units.

C. Section 04 4313 - Stone Masonry Veneer.

D. Section 04 7200 - Cast Stone Masonry.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Require attendance of parties directly affecting work of this section.
   2. Review conditions of installation, installation procedures, and coordination with related work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on cleaning compounds and cleaning solutions.
   1. Cleaning Plan: Written description of cleaning process, including materials, methods, equipment, and sequencing of work.

C. Applicator Qualifications: Submit qualifications of applicator.
   1. Certification stating applicator is experienced in the application of the specified products.
   2. List of recently completed masonry cleaning projects, including project name and location, names of owner and architect, description of cleaning products used and substrates, applicable local environmental regulations, and application procedures.

D. Environmental Regulations: Submit description for testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes and cleaning effluents. Describe any hazardous materials to be cleaned from substrates. Submit applicable local environmental regulations.

E. Protection: Submit description for protecting surrounding areas, landscaping, building occupants, pedestrians, vehicles, and non-masonry surfaces during the work from contact with masonry cleaners, residues, rinse water, fumes, wastes, and cleaning effluents.

F. Surface Preparation: Submit description for surface preparation of substrates to be completed before application of masonry cleaners.

G. Application: Submit description for application procedures of masonry cleaners.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications:

1. Manufacturer capable of providing field service representation during installation and who will approve the installer and application method.

C. Installer Qualifications:
1. Installer experienced in performing this type of work and who has specialized in work similar to the type required for this project.

D. Pre-installation Meetings
1. Comply with provisions of Section 01 3000 - Administrative Requirements.
a. Applicator and Product representative shall be present during meeting.

1.07 MOCK-UP

A. Test Panels:
1. Before full-scale application, test products to be used on test panels.
2. Review manufacturer's product data sheets to determine suitability of each product for each surface.
3. Apply products using manufacturer-approved application methods, determining actual requirements for application.
4. After 48 hours, review effectiveness of cleaning or treatment, compatibility with substrates, and ability to achieve desired results.
5. Obtain approval by Architect and Owner of workmanship, color, and texture before proceeding with work.
6. Test Panels: Inconspicuous sections of actual construction.
a. Location and number as selected by Architect.
b. Size; 4 feet by 4 feet.
c. Repair unacceptable work to the satisfaction of the Architect and Owner.

B. Acceptable panel and procedures employed will become the standard for work of this section.

C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

B. Store cleaning materials in manufacturer's packaging.

1.09 FIELD CONDITIONS

A. Do not apply products under conditions outside manufacturer's requirements, which include:
1. Surfaces that are frozen; allow complete thawing prior to installation.
2. Surface and air temperatures below 40 degrees F.
3. Surface and air temperatures above 95 degrees F.
4. When surface or air temperature is not expected to remain above 40 degrees F for at least 8 hours after application.
5. Wind conditions that may blow materials onto surfaces not intended to be treated.
6. Less than 24 hours after a rain or 6 hours before rain is expected after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Restoration and Cleaning Chemicals:
1. Diedrich Technologies, Inc: www.diedrichtechnologies.com/#sle.
2. PROSOCO: www.prosoco.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CLEANING MATERIALS

A. Water: Clean, potable, and free of oils, acids, alkalis, salts, and organic matter. Use to rinse masonry surfaces and dilute concentrated cleaners.

B. Cleaning Agent: Product types listed are manufactured by Prosoco, inc. as basis of design.

MATERIAL	COLOR/TEXTURE	CLEANER
Brick	Red	600 Detergent
	Light	Vana Trol
	Dark	Vana Trol
	Pavers	600 Detergent
	Glazed	Vana Trol
CMU	Split Face	Custom Masonry Cleaner
	Burnished/Ground Face	Light Duty Concrete Cleaner
Cast Stone	Integral Color	Light Duty Concrete Cleaner
Architectural Concrete	Natural Color	Light Duty Concrete Cleaner
	Textured	Heavy Duty Concrete Cleaner

2.03 MORTAR MATERIALS

A. Comply with requirements of Section 04 0511.

2.04 MASONRY MATERIALS

A. Unit Masonry: Section 04 2000.

B. Cast Stone Masonry: Section 04 7200

C. Stone Veneer: Section 04 4313.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

B. Do not begin until test panels have been approved by Architect.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. Close off adjacent occupied areas with dust proof and weatherproof partitions.

G. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area .

H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.03 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry and mortar to provide firm and solid bearing for new work.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

F. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.

G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.04 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

3.05 CLEANING OF MASONRY

A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Clean all exposed surfaces of new masonry of excess mortar, efflorescence, stains, and job dirt, using materials specified.

C. Clean from top down; prevent cleaning materials and rinse water from contacting non-cementitious materials.

D. Clean in accordance with manufacturer's instructions and recommendations, product data, and container label instructions.

E. Mix materials in strict accordance with manufacturer's instructions; do not dilute unless permitted by manufacturer.

F. Prevent overspray, wind drift, and splash onto surfaces not to be treated.

G. No high pressure washers are allowed.

H. Low pressure spray for wetting and rinsing is permitted. Pressure should be in the range of 400-700 psi. Equipment should produce 4-6 gallons of water per minute using a 15-40 degree fan tip (no fan tip less than a 15-degree is allowed).

3.06 AGING

A. Rub in new masonry work to match, as close as possible, adjacent original work.
   1. Use carbon black in small amounts, rubbing in well with burlap rags.

B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.

C. Continue process until acceptance.

3.07 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect the masonry cleaning work with the Contractor, Architect, applicator, and product representative, and compare with test panel results approved by the Architect. Determine if the substrates are suitably clean.

B. Manufacturers' Field Services
1. Provide the services of the manufacturer's authorized field representative to verify that installed products comply with manufacturer's requirements and with the standard established by the Architect-approved test panels.

3.08 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

D. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to the cleaning process.

END OF SECTION

SECTION 04 0511
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

B. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

C. Section 04 4313 - Stone Masonry Veneer: Installation of mortar.

D. Section 04 7200 - Cast Stone Masonry: Installation of mortar.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.

D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021.

E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2017.

J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2019.

L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.

M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

N. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.

O. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

P. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2022a.

Q. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used.

1. Where a water repellent admixture is specified, submit documentation showing that water repellent admixture is compatible with the water repellent used by the masonry brick/block manufacturer.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476and test and evaluation reports to requirements of ASTM C1019 and ASTM C939.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions, if packaged dry mortars are used.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.

1.06 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000 - Quality Requirements.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
   1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.08 FIELD CONDITIONS

A. Temperature and Humidity
   1. During cold weather construction do not lay masonry units unless the temperature is 40 degrees Fahrenheit and rising.
   2. During hot weather construction (ambient air temperature exceeds 100 degrees Fahrenheit or 90 degrees Fahrenheit with wind velocity greater than 8 mph) do not spread mortar beds more than 4 feet ahead of masonry and set brick masonry within 1 minute of spreading mortar. Fog spray cure twice daily at four hour intervals for three days during hot weather.
   3. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of greater than 99 degrees Fahrenheit in the shade, with relative humidity less than 50 percent.
   4. During hot weather protect brick masonry units from sun until units are ready to be placed in the wall.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials or made from factory premixed dry materials with addition of water only.

B. Mortar Color: Natural gray unless otherwise indicated.

1. Where colored mortar is specified it is recommended that factory premixed mortar be used. Mortar color shall be consistent throughout the project with the sample produced and approved on the mock-up wall.

C. Mortar Mix Designs: ASTM C270, Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
2. Exterior Masonry Veneer: Type N.
3. Exterior, Loadbearing Masonry: Type N.
4. Exterior, Non-loadbearing Masonry: Type N.
5. Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
6. Interior, Loadbearing Masonry: Type N.
7. Interior, Non-loadbearing Masonry: Type N.
8. Pointing Mortar for Prefaced or Specially Faced Unit Masonry: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.
9. Glass Unit Masonry: Type N mortar and Type O pointing mortar.

D. Grout Mix Designs:
1. Refer to Contract Documents for grout strength and slump requirements. Provide premixed or job mixed grout in acordance with ASTM C94/C94M. It is permitted to provide fine or coarse grout in accordance with the table below:

Grout Type	Maximum Grout Pour Height	Minimum Clear Width of Grout Space	Minimum Clear Grout Space Dimensions for Grouting Cells of Hollow Units
Fine	1'-0" 5'-0" 12'-0" 24'-0"	3/4" 2" 2 1/2" 3"	1 1/2" x 2" 2" x 3" 2 1/2" x 3" 3" x 3"
Coarse	1'-0" 5'-0" 12'-0" 24'-0"	1 1/2" 2" 2 1/2" 3"	1 1/2" x 3" 2 1/2" x 3" 3" x 3" 3" x 4"

2. Grout shall be poured in maximum lift heights (increment of grout height within a pour height) and maximum grout heights (total height of masonry to be poured prior to the erection of additional masonry) noted below:
   a. Grout in partially grouted walls shall be placed in pour heights equal to the bond beam spacing not to exceed 5'-4". Pour heights are permitted to be increased up to 12'-8" provided the following conditions are met:
      1) The masonry has cured for a minimum of 4 hours.
      2) Grout slump is maintained between 10 in and 11 in.
      3) No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
   b. Grout in fully grouted walls are permitted to be poured per the maximum pour heights provided in the table above. Lift heights shall not exceed 5'-4" except that it permitted to increase lift heights to 12'-8" provided the following conditions are met:
      1) The masonry has cured for a minimum of 4 hours.
      2) Grout slump is maintained between 10 in and 11 in.
   c. Grout in lintel beams shall be placed in lift heights equal to the full depth of the beam unless noted otherwise.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Color: Mineral pigments added as required to produce approved color sample.

B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

C. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Color as required to produce approved color sample.

D. Masonry Cement: ASTM C91/C91M.
   1. Type: Type N; ASTM C91/C91M.

E. Hydrated Lime: ASTM C207, Type S.

F. Quicklime: ASTM C5, non-hydraulic type.

G. Mortar Aggregate: ASTM C144.

H. Grout Aggregate: ASTM C404.

I. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Pigment:
      a. Face Brick: Natural Gray
      b. Brick Pool Coping: Match Brick
      c. Architectural CMU: Match Unit
      d. Cast Stone/CSMU: Match Unit
      e. Existing Construction: Match existing mortar color.
   2. Manufacturers:
      a. Quikrete Companies: www.quikrete.com
      b. Amerimix, an Oldcastle brand, Bonsal American: www.amerimix.com
      c. TXI: www.txi.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

J. Water: Clean and free from deleterious acids, alkalies, and organic matter.

K. Integral Water Repellent Admixture: Polymeric liquid or powder admixture added to mortar at the time of manufacture.
   1. Performance of Mortar with Integral Water Repellent:
      a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:
         1) No water visible on back of wall above flashing at the end of 24 hours.
         2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
         3) No more than 25 percent of wall area above flashing visibly damp at end of test.
      b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      d. Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
   2. Required only at all single wythe exterior masonry wall applications and in conjunction with hollow brick used on the back of parapet walls.
   3. At single wythe exterior concrete masonry, water repellent admixture shall be compatible with the water repellent used by the masonry unit manufacturer.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

D. No Admixtures are allowed except water repellents where required.

E. Do not use anti-freeze compounds to lower the freezing point of mortar.

F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

C. No Admixtures are allowed except water repellents where required.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 PREPARATION

A. Plug clean-out holes for grouted masonry with matching masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

A. Contractor shall note that the dimensions shown on the floor plans and plan details are in some instances nominal masonry dimensions. The contractor is responsible for coordinating the masonry layout to provide 3/8” joints. If conflict occurs, contractor shall contact Architect prior to installing masonry.

B. Site Verification of Conditions
1. Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
2. Verify that wall ties, and reinforcement are properly located.
3. Verify that flashings are properly located and intact.

C. Mortar and Grout
1. Head joints: Regardless of thickness, completely fill with mortar or grout. Do not slush full.
2. Except at the finishing course, stop grout approximately 1" below the top of the last course.
3. At the finishing course, bring the last grout pour flush with the top of the brick.
4. Whenever possible, grout from the inside face of the masonry.
5. Take extreme care to prevent grout or mortar staining the face of masonry to be left exposed or unpainted.
6. Protect sills, ledges, offsets, door jambs, corners, and similar points from damage and from collecting mortar or grout.
7. Immediately remove mortar and grout from areas where they are not scheduled to be placed.
8. All mortar shall be hard and durable after curing. Scratchable mortar is not acceptable.
9. Perform grouting in strict accordance with the provisions of the Building Code.
10. Solidly fill vertical cells containing reinforcement.

11. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.

D. Install mortar and grout to requirements of section(s) in which masonry is specified.

E. Work grout into masonry cores and cavities to eliminate voids.

F. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

G. Do not displace reinforcement while placing grout.

H. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard Concrete Masonry Units.

B. Clay facing brick.

C. Reinforcement and anchorage.

D. Flashings.

E. Lintels.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 0100 - Maintenance of Masonry.

C. Section 04 0511 - Masonry Mortaring and Grouting.

D. Section 05 5000 - Metal Fabrications: fabricated steel items.

E. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.

F. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

G. Section 07 2500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.

H. Section 07 6200 - Sheet Metal Flashing and Trim: Metal through-wall masonry flashings.

I. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

J. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

B. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2017a.

C. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

D. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

E. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

F. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

H. NCMA TEK 19-7 - Characteristics of Concrete Masonry Units with Integral Water Repellent, 2008

I. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings

1. Comply with provisions of Section 01 3000 - Administrative Requirements.

2. Not less than one week prior to commencing all masonry related items a pre-installation conference shall be held at the site. Attendance is mandatory for all trades affected by this section. The general contractor shall be responsible for coordinating this conference with all affected trades (Including but not limited to jobsite superintendent, masonry contractor, masonry foreman, waterproofing and flashing contractor, concrete block insulator and architect). The architect will conduct the business of this meeting. All masonry work that takes place prior to this conference shall be marked as rejected and shall be removed, no exceptions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, masonry reinforcement, size and type of fasteners, and accessories for brick/blockwork support system.

D. Samples: Submit four samples of facing brick and architectural masonry units to illustrate color, texture, and extremes of color range. Sample shall be of actual unit specified to be installed.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.

B. At all units (concrete masonry, stone, cast stone or other) for which an integral water repellent was specified to be in the units, perform the Water Droplet Test as recommended in the performance criteria of NCMA TEK 19-7 associated with the Water Droplet Test Method.

C. Certifications
   1. Do not commence placement of masonry until mortar mix designs have been reviewed and approved by the Testing Laboratory and all governmental agencies having jurisdiction and until copies are at the job site.

1.07 MOCK-UP

A. Field Sample (Panels for texture and color approvals only)
   1. In an area on the site where approved by the Architect, provide sample masonry panels.
      a. Make each sample panel approximately 4'-0" high and 6'-0" long.
      b. Provide one sample panel for each combination of masonry units, bond pattern, mortar color, and joint type used in the Work.
      c. For renovation projects, locate panel adjacent to existing building to allow side by side viewing of both existing building and panel. Panel shall be located in an area that receives both direct sun and shade.
      d. Revise as necessary to secure approval from Owner and Architect.
      e. Completely demolish and remove from the job site upon completion and acceptance of the work.

B. Mock-Ups (Wall for quality control purposes)
   1. A mock-up wall shall be constructed only after the pre-installation conference.
   2. The Architect shall select a section of exterior wall within the building that shall be used for a wall mock-up to determine quality of workmanship for the entire project. The mock-up shall consist of approximately 50 lineal feet of exterior wall and shall include straight wall, corners, control and expansion joints, window installation, anchors and reinforcing, and flashings. This mock-up shall incorporate all aspects of the accepted masonry sample panel as well including proper cleaning techniques. Cleaning agent manufacturer’s representative shall be on site to observe and instruct the cleaning portion.

3. Installation of all materials and products into the wall shall be in accordance with all applicable specifications as noted in the project manual and as shown on the drawings.
4. Upon completion and acceptance of the wall mock-up and quality of workmanship, the wall shall be photographically documented by the Contractor as a record. Provide one copy of photos to each the Owner, the Architect and the Contractor. The wall shall then be incorporated into the project and shall be the standard for all masonry work on the project.
5. No work shall proceed until the mock-up wall is approved.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. All masonry products stored on site shall be properly covered from the weather to prevent deterioration and moisture penetration. Broken or damaged masonry products shall be rejected. Do not double-stack pallets.

C. Storage and protection of masonry embedded flashing;
1. Comply with manufacturer's recommendations for storage and handling of each product.
2. Wall Flashing and Surface Conditioner shall be delivered in the original, unopened manufacturer’s containers with all labeling information fully visible.
3. On-Site Storage of unopened cartons shall be such that the material is kept dry and is not stored at temperatures in excess of 100 deg. F. Pallets of cartons should not be double stacked for on-site storage.
4. Surface Conditioner is non-flammable. Refer to product label before use.

D. Acceptance at Site
1. Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.
2. Materials with missing or illegible identification shall be rejected.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Manufacturers:
1. Boral Concrete Products: www.boralconcreteproducts.com
2. Oldcastle Architectural, Jewell Concrete Products: www.jewellcp.com.
3. Spectra Development Corporation: www.spectraglaze.com.
4. Texas Building Products, Inc.: www.texasbuildingproducts.com.
5. Trenwyth Industries, Inc.: www.echelonmasonry.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Standard Concrete Masonry Units: Comply with referenced standards and as follows:
1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
3. Use bullnose type concrete masonry units at all edges and exterior corners in "Activity Rooms" and "Gymnasiums".
4. Load Bearing/Non-Load Bearing Units: ASTM C90, lightweight.
5. Load-Bearing Units/ Non-Loadbearing Units: ASTM C90, normal weight
   a. Provide at all sound wall locations unless noted otherwise.
6. 4" wide units shall be provided as hollow cell units.

2.02 BRICK UNITS

A. Manufacturers:
1. Acme Brick Company: www.brick.com

2. Elgin Butler Company: www.elginbutler.com.
3. Endicott Clay Products Co: www.endicott.com.
4. General Shale Brick: www.generalshale.com.
5. Meridian Brick LLC : www.meridianbrick.com/#sle.
6. Interstate Brick: www.interstatebrick.com
7. Sioux City Brick: www.siouxcitybrick.com
8. Summit Brick: www.summitbrick.com
9. Kansas Brick and Tile/Cloud Ceramics: www.kansasbrick.com
10. Substitutions: See section 01 6000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: Refer to Section 01 6210 – Schedule of Materials and Colors.
2. Nominal size: Modular.
3. Special shapes: Provide special shapes at all intersections not equal to 90 degrees to conform to the brick selected or of the same type and finish in the brick allowance. Where solid brick are noted on the plans, provide brick of appropriate size without cores.
4. Compressive strength: As measured in accordance with ASTM C67.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
1. Blok-Lok Limited: www.blok-lok.com/#sle.
2. Hohmann & Barnard, Inc: www.h-b.com/sle.
3. WIRE-BONDwww.wirebond.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. In addition to all other specification requirements, veneer anchors shall be designed by a professional engineer licensed in Texas, hired by the Contractor, where the horizontal distance is greater than 4 1/2 inches between the inside face of the masonry veneer (e.g. brick, concrete masonry, cast stone, etc...) and the outside face of the structural backup system (e.g. CMU, ICF, face of cold formed metal framing members, etc...).

C. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; uncoated finish.

D. Wire reinforcement: Reinforced hot dip galvanized wall reinforcing in conformance with ASTM A951, for high tensile steel. hot-dipped galvanized to comply with ASTM A153, Class BMill-galvanized wire reinforcement shall not be permitted on any part of the project. 9 gage wire, deformed to develop minimum surface bond of 527 PSI when cast in ASTM Class A mortar cubes. Provide rod spacings and veneer anchor dimensions to locate rods and veneer anchors in mortar to comply with the requirements of the applicable version of the Masonry Standards Joint Committee document TMS 402, referring to the construction drawings for dimensions of wythe thicknesses and dimensions between wythes.

E. Veneer anchor wires: Reinforced hot dip galvanized wire in conformance with ASTM A951, for high tensile steel, hot-dipped galvanized to comply with ASTM A153, Class B. Mill-galvanized wire reinforcement shall not be permitted on any part of the project. 9 gage wire. Provide rod spacings and veneer anchor dimensions to locate rods and veneer anchors in mortar to comply with the requirements of the applicable version of the Masonry Standards Joint Committee document TMS 402, referring to the construction drawings for dimensions of wythe thicknesses and dimensions between wythes.

F. Horizontal Bedjoint Reinforcement in Concrete Masonry, and Masonry Veneer Anchors with Concrete Masonry Backup Systems: Install bedjoint reinforcement at 16" on center in all concrete masonry walls, excluding masonry veneer wythes unless they are laid at the same time as backup masonry. Horizontal bedjoint reinforcement, as well as deformed rebar, shall continue through all crack control joints in all concrete masonry walls (both load-bearing and non-load-bearing, both interior and exterior).
   1. Single-wythe concrete masonry walls without masonry veneer: Ladder Type, using #220 Ladder-Mesh as manufactured by Hohmann & Barnard, Inc or equal.
   2. Single-wythe concrete masonry backup with masonry veneer laid at the same time: Ladder Type, using #230 Ladder-Tri-Mesh as manufactured by Hohmann & Barnard, Inc or equal.
   3. Single-wythe concrete masonry backup with masonry veneer laid after backup wythe: Install one of the following two options:
      a. Provide bedjoint reinforcement with eyelets flush-welded, so as to avoid wire buildup of wire laminations, and adjustable double-pintle-leg anchors at 16" on center along the bedjoint reinforcement, using Adjustable Truss Lox-All Adjustable Eye-Wire with TRU-JOINT as manufactured by Hohmann & Barnard, Inc or equal, or
      b. Provide bedjoint reinforcement without eyes, as noted above for Single-wythe concrete masonry walls without masonry veneer, and in alternating bedjoints with bedjoint reinforcement so as to avoid wire buildup of wire laminations, provide Adjustable Wall Ties (Pintles and Eyes) as manufactured by Hohmann & Barnard, Inc or equal, at 16" on center each way.
   4. Multiple-wythe concrete masonry walls, excluding masonry veneer wythes: Composite Truss Type with two rods in each wythe, using #140 Truss Twin-Mesh as manufactured by Hohmann & Barnard, Inc or equal. At walls with more than two structural wythes, alternate pairs of wythes being tied together at 8" on center so that each pair of wythes is being tied together at 16" on center.
      a. To anchor masonry veneer to multiple-wythe concrete masonry backup systems: Install Adjustable Wall Ties (Pintles & Eyes) as manufactured by Hohmann & Barnard, Inc or equal at 16" on center each way.

G. Masonry Veneer Anchors with Cast-in-place Concrete Backup Systems:
   1. At concrete backup systems formed with Expanded Polystyrene Formwork (Insulating Concrete Forms): It shall NOT be permitted to permanently anchor masonry veneer by anchoring to flanges of ICF web materials embedded in the expanded polystyrene, such as plastic or light-gage metal. One of the following options shall be installed:
      a. 2-SEAL Concrete Ties with 2-SEAL Byna-Lok Wire Ties as manufactured by Hohmann & Barnard, Inc or equal embedded in the concrete with a maximum vertical spacing of 18" and a maximum horizontal spacing of 16".
      b. Adjustable sheet metal anchors customized for the ICF industry and embedded in the concrete, using TIE-KEY adjustable sheet metal anchors as manufactured by Reward Wall Systems, or equal, to be mounted temporarily on plastic flanges of ICF web material, at a maximum tributary area of 1.5 square feet (e.g.16" vertical and 12" horizontal for Reward Systems; 18" vertical and 8" horizontal for Nudura wall systems). Anchors shall be hot-dipped galvanized to comply with ASTM A153, Class B.
   2. At concrete backup systems with temporary forms that are removed, one of the following options shall be installed:
      a. Before concrete is poured, mount 22 ga hot-dip galvanized dovetail channels to receive dovetail veneer anchors, using #305 Dovetail Slot as manufactured by by Hohmann & Barnard, Inc or equal. After concrete is poured and temporary forms are removed, install 12 ga hot-dip galvanized dovetail anchors with vee wall ties at 16" on center each way, using #315 Flexible Dovetail Brick Tie as manufactured by Hohmann & Barnard, In., or equal.

b. If dovetail channels are not installed as noted above, the Contractor shall be permitted to install a two-piece concrete anchored adjustable wire tie system at 16" on center each way, using 2-SEAL Concrete Ties with 2-SEAL Byna-Lok Wire Ties as manufactured by Hohmann & Barnard, Inc. or equal with concrete screws as recommended by the manufacturer.
c. For precast concrete systems at storm shelters:
1) Anchors shall have 1 1/2" maximum penetration into concrete
2) Wall reinforcement shall be located with nondestructive methods (e.g. ferroscanning equipment)
3) Drilling for anchors shall be done with masonry drill bit incapable of penetrating steel reinforcing.
4) For spalls or any other damage to the precast concrete, walls shall be repaired as required by Precast Concrete Engineer.

H. Masonry Veneer Anchors with Stud Backup Systems: Install a two piece anchored adjustable wire tie system at 16" on center each way, with screws as recommended by the manufacturer and as required by the applicable version of TMS 402.
1. Exterior stud walls with masonry veneer:
a. Thermal 2-Seal Wall Ties as manufactured by Hohmann & Barnard, Inc.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Interior stud walls with masonry veneer:
a. DW-10 Wall Ties as manufactured by Hohmann & Barnard, Inc.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FLASHINGS

A. Metal Flashing Materials: Products as specified in Section 07 6200.

B. Rubberized Asphalt Flashing: Provide 40 mil. Flexible rubberized asphalt, self-sealing through-wall flashing with silicone release sheet, wall flashing accessories, flashing at spandrels and cavities; under copings, band courses, and sills; over lintels and shelf angles, flashings at low roof to high wall conditions and all other wall conditions necessary to provide a watertight wall assembly and as specified in Section 07 2500 - Weather Barriers.
1. Manufacturers:
a. See Section 07 2500 - Weather Barriers for manufacturers thru-wall, transition membrane required as part of the complete weather barrier assembly.
2. Wall Flashing Accessories
a. Provide manufacturers surface conditioner and primer.
b. Termination Mastic:
1) Description: Rubberized asphalt-based mastic with 200 g/l max. VOC Content.
c. Provide stainless steel type 304 termination bar equal to Hohmann & Barnard model T2-FTS with pre-punched holes at 8-inches on center max.
d. Provide three dimensional preformed external corners and end dams.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
1. Manufacturers:
a. Blok-Lok Limited: www.blok-lok.com.
b. Hohmann & Barnard, Inc: www.h-b.com/sle.
c. WIRE-BOND: www.wirebond.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding; 1/2 inch wide by maximum lengths available.
1. Manufacturers:

a. Hohmann & Barnard, Inc: www.h-b.com/sle.
b. WIRE-BOND: www.wirebond.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
a. Manufacturers:
1) Hohmann & Barnard, Inc; Mortar Trap: www.h-b.com/sle.
2) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
3) Substitutions: See Section 01 6000 - Product Requirements.

D. Nailing Strips: Softwood lumber, preservative treated; as specified in Section 06 1000.

E. Weeps:
1. Type: Molded PVC grilles, insect resistant.

F. Cavity Vents:
1. Type: Molded PVC grilles, insect resistant.

G. Bond Break Material - Provide one layer of 6 mil polyethylene equal to “Visqueen Vapour Barrier” as a bond breaker between all clay masonry and CMU in the same wythe. Rake joint back 3/8” and provide continuous sealant at joint.

2.07 LINTELS

A. All concrete masonry lintels, not including 4" nominal concrete masonry veneer lintels, shall be reinforced concrete masonry lintels as specified on the Structural Drawing Sheets unless steel beam supports are shown on the Structural Drawings. Where steel beam supports are shown, the concrete masonry shall be bonded to the top of the steel beam with 1/2" diameter Nelson D2Lbars x 24" long at 16" on center.

B. All exterior masonry veneer supports over openings shall be as shown on the Structural Drawings.

C. For interior masonry veneers with an air space between the veneer and backup, Interior masonry veneer supports over openings shall be the same as for exterior veneer supports, as shown on the Structural Drawings.

D. For interior masonry veneer with a mortar-filled collar joint shown on the Drawings, interior masonry veneer supports shall be loose steel lintels as scheduled on the Structural Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall note that the dimensions shown on the floor plans and plan details are nominal masonry dimensions. The contractor is responsible for coordinating the masonry layout to provide 3/8” joints. If conflict occurs, contractor shall contact Architect prior to installing masonry.

B. Verify that field conditions are acceptable and are ready to receive masonry.

C. Verify that related items provided under other sections are properly sized and located.

D. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Surface Preparation for Masonry Units

1. Do not commence installation until foundations are clean, rough, and level.
2. Remove all laitance and foreign material from top of foundation.
3. Verify that the foundation elevation is such that the bed joint thickness will be between 3/8" and 1/2", and that the foundation edge is true to line.
4. Clean projecting dowels free from loose scale, dirt, concrete, and other material that will inhibit bond.
5. Verify that dowels are in proper location.

D. Surface Preparation for Rubberized Asphalt Flashing
1. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to flashing installation. Allow primer to dry completely before flashing application.

E. Collection System and Weeps
1. Clean flashing and weep holes so they are free of mortar droppings and debris immediately prior to installing collection system or weep.
2. Remove projecting mortar and other protrusions from substrate.
3. Remove mortar and debris from cavity spaces, wall ties, and reinforcing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. During cold weather construction do not lay masonry units unless the temperature is 40 degrees Fahrenheit and rising.

C. During hot weather construction (ambient air temperature exceeds 100 degrees Fahrenheit or 90 degrees Fahrenheit with wind velocity greater than 8 mph) do not spread mortar beds more than 4 feet ahead of masonry and set brick masonry within 1 minute of spreading mortar. Fog spray cure twice daily at four hour intervals for three days during hot weather.

D. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of greater than 99 degrees Fahrenheit in the shade, with relative humidity less than 50 percent.

E. During hot weather protect brick masonry units from sun until units are ready to be placed in the wall.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Bed joints in masonry units shall course out with bed joints in adjacent masonry wythes at vertical intervals of 16”.

D. Cut out and repoint defective joints.

E. On all joints exposed to the weather, tool and make smooth, solid, and watertight.

F. All joints shall be thumbprint hard prior to tooling.

G. Use 18” sled on bed joints, brush wall, and retool joints.

H. Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave at conditions exposed to view. Strike joints flush where a fluid applied weather barrier will be installed as specified in Section 07 2500 - Weather Barriers.
4. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.

I. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners, except for units laid in stack bond.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

L. Brick and CMU wythes shall be laid in a true and straight alignment. Exterior masonry shall be laid-up separately.

M. Unless otherwise indicated on the Drawings, install masonry plumb, level, and true to line, with square angles and corners. Do not commence installation of the work until horizontal and vertical alignment of the foundation is within 1” plumb and the lines shown on the Drawings.

N. Use line blocks whenever possible. When it is absolutely necessary to use a line pin, fill the hole immediately after the pin is withdrawn.

O. Use only masonry that are clean and free from dust and other foreign matter and lay only dry masonry units.

P. Do not use bonding headers on grouted masonry unless specifically so directed by the Architect.

Q. Masonry with cracks and or chipped faces will be rejected if non-compliant with the limits noted in ASTM C216. If such units are discovered in the finished wall, the Contractor shall remove the units and replace with new units at no cost to the Owner.

R. Lay only dry concrete masonry units.

S. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.

T. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.

U. Bed joints: A complete mortar-to-unit bond is required on all masonry.
   1. Avoid fins of bed joints protruding into grout space or cavity.
      a. If they occur, leave in place if not projecting more than the bed joint thickness.
      b. Do not, in any case, cut off and drop into the grout space or cavity.

V. Head joints: Regardless of thickness, completely fill with mortar or grout. Do not slush full.

W. Lay both Wythes of the wall to a line.

X. Provide reinforcement as shown on the drawings, fully embedded in grout and not in mortar or mortar joints. Provide required metal accessories to insure adequate alignment of steel during grout filling operations.

Y. At locations where items are mounted on/against split face CMU (i.e. door/window jambs, fire extinguisher cabinets, electric water coolers, etc.), grind split face CMU to allow flush, level installation.

3.06 WEEPS/CAVITY VENTS

A. Place weep vents in head joints at exterior wythe of cavity wall located immediately above all flashings, ledges, heads of lintels, sills, and low roof to high wall conditions spaced 24 inches on center for clay and stone masonry units and 32 inches on center for concrete masonry units, unless otherwise shown. Leave the side of the masonry units clear from mortar (unbuttered) forming the vent space. Place the vent material into joint, directly on top of flashing material, prior to installing the second masonry unit. Install the weep vents as the wall is being erected so joints do not become filled with mortar or debris. Install a minimum of two weeps above each exterior door/window.

B. Install cavity vents in veneer and cavity walls at 24 or 32 inches on center horizontally near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install 1 continuous row at base of wall and over all wall openings directly on flashing. To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the collection system to at least 6" above the top of the collection system.

D. Install with the offset edge pointing up the wall.

E. Lay the first 1 or 2 courses of masonry at flashing level, then install the collection system continuously by placing it against the inside of the openings. No fasteners or adhesives are required.

F. Compress the collection system horizontally so it can be forced into cavities slightly smaller than its nominal thickness without affecting performance. When forcing the collection system into a cavity, be sure mortar has set sufficiently to resist outward pressure from product.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Refer to the Structural and Architectural Drawings for reinforcement required in masonry.

B. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

D. Place continuous joint reinforcement in first and second joint below top of walls.

E. Lap joint reinforcement ends minimum 6 inches.

F. Do not install masonry anchors at locations where fasteners will penetrate through wall flashing.

G. Do not use reinforcement having any of the following defects.
   1. Bar lengths, depths, or bends exceeding the specified tolerances.
   2. Bends or kinks not indicated on the Drawings or required for the Work.
   3. Bars with cross-section reduced due to excessive rust or other causes.

H. Masonry Tie Installation: Set wall plate in full bed of compatible sealant over substrate. Install fasteners to engage structural framing/masonry, ensuring fasteners are installed snug and straight. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Install stainless steel drip edge flashing in accordance with Section 07 6200. Drip edge flashing shall be continuous including at elevation changes (i.e. steps).
   2. Install flashing to dry surfaces when air and surface temperatures are 40ºF and above.
   3. All flashings shall be installed to produce a fully watertight assembly.
   4. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
   5. Do not expose flashing membrane to sunlight for more than thirty days prior to enclosure.
   6. Prepare the masonry surfaces so that they are smooth and free of obstructions where installing flashings. Apply the surface conditioner per the manufacturers written recommendations for proper adhesion of the flashings.
   7. Precut pieces of flashing to easily handled lengths for each location.
   8. Metal Through Wall Flashing Layer:
      a. Provide stainless steel through wall flashing fabricated based on field verification in accordance with Section 076200.
      b. Clean and prime substrates to receive flashing, and install flashing in a full bed of sealant, fastened at 16" o.c. maximum.
      c. Seal and rivet laps, solder end dams and transitions - provide end dams at all transitions, terminations to openings and expansion joint conditions.
      d. Install 1x1 sealant cant at transitions in plane to receive membrane flashing.
      e. Prime all surfaces to receive membrane through wall flashing per manufacturer requirements.
      f. Metal flashing shall be continuous including at elevation changes (i.e. steps).
   9. Remove release paper and position flashing carefully before placing it against the surface.
   10. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
   11. Overlap adjacent pieces 6” and roll all seams with a steel hand roller.
   12. Install prefabricated external and internal corners and end dams.
   13. Extend the flashing from 1/2” outside the face of the exterior wall, through the exterior masonry wythe, and up the cavity space a minimum of 8”. Install termination bar at top of flashing and seal with mastic.
   14. Install weeps as specified keeping the joint clean of mortar to insure proper weeping action.
   15. Membrane flashing shall not be permanently exposed to sunlight.
   16. At all flashing terminations to openings, expansion joints, and changes in height, provide stainless steel and membrane formed end dams with all seams sealed watertight. Provide compressible filler at the end of all flashings at steel lintels.
   17. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts, and penetrations for a completely watertight condition.

B. Laying Masonry Walls: Provide a solid surface at flashing areas using inverted lintels, solid or filled masonry units. Flash at all breaks in wall face where cells are not grouted.

C. At wall base flashings, place the flashing below the mortar bed.

D. Provide continuous flashing at all locations where exterior wall is penetrated by a steel or concrete member.

E. At all lintels, shelf angles, door and window heads, install specified metal drip flashing in accordance with Section 07 6200. Extend flashing a minimum of 8” past the jambs of doors and windows and at other masonry openings. Install three dimensional end dams at all inside and outside corners.

F. At low roof to high wall flashing conditions install the through wall flashings as described above. Carefully coordinate the placement of the flashings and weeps with the general construction, assuring no weeps occur below the adjacent low roof flashings.

G. Contractor shall provide an in-place mockup for review by Architect and Consultant of complete through wall flashing system, including stainless steel drip edges, incorporating end dams at a typical termination of flashing.
   1. Failure to provide mockup or review of through wall flashing materials prior to installation of insulation and masonry may result in removal of materials as required to observe installed conditions at flashings.
   2. Through wall flashings that are improperly installed or installed in the wrong position, regardless of whether cladding has been installed or not, shall be removed by the Contractor and new flashings installed to the proper condition.

H. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 GROUTED COMPONENTS

A. Fill one cell of CMU with grout and 1 - #5 bar vertical at each window and door jamb in CMU walls, from floor level to top of wall.

B. Fill 3 cells of CMU with grout and 1 - #5 bar vertical in each cell at all exterior corners of CMU walls, fill full height of wall and extend #5 bar into bond beam a minimum of 6” then bend 90° and extend a minimum of 6”.

C. See drawings for other areas of grout fill required in CMU.

D. Where the collar joint is to be grouted between the wythes of masonry, provide expanded metal or mortar/grout screen at the beginning of the grout.

E. All vertical bars shall be dowelled to the foundations with same size reinforcing bar.

F. Lap splices minimum 48 bar diameters.

G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

H. Place and consolidate grout fill without displacing reinforcing.

I. At bearing locations, fill masonry cores with grout for a minimum 8 inches either side of opening.

3.11 CONTROL AND EXPANSION JOINTS

A. Locate 3/8” wide expansion and control joints as indicated on the drawings. However in no case shall they exceed 20’-0” in distance. Contractor shall ensure that joints occur at intervals no more than as noted above and notify the Architect for coordination of placement if additional joints are required. Keep vertical joints straight, true and continuous from top to bottom of masonry.
   1. Expansion joints shall be completely free of mortar and the joint reinforcement shall not continue across the expansion joint. Keep vertical joints straight, true and continuous from top to bottom of masonry. Detail joint as shown on the drawings
   2. At control joints horizontal reinforcing shall run continuous through joint. Detail joint as shown on the drawings.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Form expansion joint as detailed on drawings.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. The masonry walls shall be covered at the end of each workday and when work is not in progress. The walls shall be covered with heavy plastic sheeting or water repellent tarps and shall extend a minimum of 2’-0” down each side of the wall and be securely held in place.

END OF SECTION

SECTION 04 4313
STONE MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Anchored cut stone veneer at exterior walls.

B. Adhered cut stone veneer at interior walls.

C. Metal anchors and accessories for anchored veneer.

D. Accessories for adhered veneer.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Masonry Mortaring and Grouting: Setting and pointing mortar.

B. Section 04 2000 - Unit Masonry: Joint reinforcement, Ties, Anchors, and Through-wall flashing.

C. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing or block.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Flashings.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone; 2022.

C. ASTM C1242 - Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems; 2018a.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ILI (HB) - Indiana Limestone Handbook; 2007.

F. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Comply with provisions of Section 01 3000 - Administrative Requirements.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Not less than one week prior to commencing all masonry related items a pre-installation conference shall be held at the site. Attendance is mandatory for all trades affected by this section. The general contractor shall be responsible for coordinating this conference with all affected trades (Including but not limited to jobsite superintendent, masonry contractor, masonry foreman, waterproofing and flashing contractor, concrete block insulator and architect). The architect will conduct the business of this meeting. All masonry work that takes place prior to this conference shall be marked as rejected and shall be removed, no exceptions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on stone units, mortar, and reinforcement.

C. Samples: Submit two stone samples illustratingminimum and maximum stone sizes, color range, texture, and markings.

D. Samples: Submit mortar color samples.

1.06 QUALITY ASSURANCE

A. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum five of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum five years ofdocumented experience.

1.07 MOCK-UP

A. Field Sample (Panels for texture and color approvals only)
   1. In an area on the site where approved by the Architect, provide sample masonry panels.
      a. Make each sample panel approximately 4'-0" high and 6'-0" long.
      b. Provide one sample panel for each combination of masonry units, bond pattern, mortar color, and joint type used in the Work.
      c. For renovation projects, locate panel adjacent to existing building to allow side by side viewing of both existing building and panel. Panel shall be located in an area that receives both direct sun and shade.
      d. Revise as necessary to secure approval from Owner and Architect.
      e. Completely demolish and remove from the job site upon completion and acceptance of the work.

B. Mock-Ups (Wall for quality control purposes)
   1. A mock-up wall shall be constructed only after the pre-installation conference.
   2. The Architect shall select a section of exterior wall within the building that shall be used for a wall mock-up to determine quality of workmanship for the entire project. The mock-up shall consist of approximately 50 lineal feet of exterior wall and shall include straight wall, corners, control and expansion joints, window installation, anchors and reinforcing, and flashings. This mock-up shall incorporate all aspects of the accepted masonry sample panel as well including proper cleaning techniques. Cleaning agent manufacturer's representative shall be on site to observe and instruct the cleaning portion.
   3. Installation of all materials and products into the wall shall be in accordance with all applicable specifications as noted in the project manual and as shown on the drawings.
   4. Upon completion and acceptance of the wall mock-up and quality of workmanship, the wall shall be photographically documented by the Contractor as a record. Provide one copy of photos to each the Owner, the Architect and the Contractor. The wall shall then be incorporated into the project and shall be the standard for all masonry work on the project.
   5. No work shall proceed until the mock-up wall is approved.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect stone from discoloration during storage on site.

B. Provide ventilation to prevent condensation from forming on stone.

1.09 FIELD CONDITIONS

A. Cold Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stone Quarriers:
   1. Oldcastle/ Custom Stone Supply
   2. Mezger
   3. Continental Cut Stone Quarries
   4. Superior Stone, Inc.
   5. Texas Quarries
   6. Texas Stone Products
   7. Texas Masonry Products

B. Stone Masonry Reinforcement and Accessories - Anchored Veneer:

1. Blok-Lok Limited: www.blok-lok.com.
2. Hohmann & Barnard, Inc: www.h-b.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STONE

A. Limestone: Limestone; complying with ASTM C568/C568M Classification II - Medium Density.
   1. Grade: Standard, per ILI (HB).
   2. Color: Reference Section 01 6210-Schedule of Materials and Colors.
   3. Surface Texture: Chopped.

2.03 MORTAR APPLICATIONS

A. Mortar and Grout: As specified in Section 04 0511.

B. Setting Bed Mortars: Setting bed used to adhere stone veneer units to cement board.
   1. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.

2.04 ACCESSORIES - ANCHORED VENEER

A. Horizontal Joint Reinforcement and wall ties: As specified in Section 04 2000.

B. Other Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.

C. Setting Buttons and Shims: Plastic.

D. Flashings: As specified in Section 04 2000 and 07 6200.

E. Weep/Cavity Vents: Molded PVC grille insect resistant.

F. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.05 ACCESSORIES - ADHERED VENEER

A. Thin-Set Bonding Mortar
   1. Polymer fortified, thin-set mortar for interior installation of thin stone.
   2. Meet or exceed ANSI A118.4 Shear Bond Strength Requirements & ANSI A118.11.
   3. Basis of Design: Laitcrete MVIS Hi-Bond Mortar:

B. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.06 STONE FABRICATION - ANCHORED VENEER

A. Nominal Thickness: 4 to 5 inch.

B. Nominal Face Size: 4 to 20 inch.

C. Pattern and Coursing: Ashlar.

D. Fabricate for 3/8 inch beds and joints.

E. Bed and Joint Surfaces:
   1. Cut or sawn top and bottom for full thickness of unit.

F. Backs: Rough.

G. Form stone corners to irregular joint profile. Clean jagged corners from stone in preparation for setting.

H. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

I. Cut drip slot in bottom surface of work projecting more than 1/2 inch over window frame. Size slot not less than 3/8 inch wide and 1/4 inch deep for full width of projection.

2.07 STONE FABRICATION - ADHERED VENEER

A. Comply with ASTM C1242 requirements for adhered stone system without mechanical anchors for maximum stone weight and maximum individual stone panel size.

B. Comply with TMS 402/602 size requirements for adhered stone veneer units for maximum thickness, maximum face dimension, maximum face area and maximum weight per square foot.

C. Nominal Thickness: 3/4 inch to 1-1/4 inches.

D. Nominal face size: Match full size unit.

E. Style: Match full size unit.

F. Fabricate for 3/8 inch beds and joints.

G. Backs: Sawn.

H. Form stone corners to irregular joint profile. Clean jagged corners from stone in preparation for setting.

I. Special shapes: Provide special shapes at all intersections not equal to 90 degrees to conform to the stone selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION - ANCHORED VENEER

A. Establish lines, levels, and coursing. Protect from disturbance.

B. Clean stone prior to installation. Do not use wire brushes or implements that mark or damage exposed surfaces.

C. Clean sawn surfaces of rust stains and iron particles.

3.03 PREPARATION - ADHERED VENEER

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter using approved acid solutions, solvents, or detergents, and then rinse surfaces thoroughly with clean water.

C. Roughen smooth concrete surfaces and apply bonding compound in accordance with manufacturer's written installation instructions.

D. Apply dash bond coat to solid bases and moist cure for at least 24 hours before applying setting bed.

3.04 INSTALLATION - ANCHORED VENEER

A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches and seal watertight.

B. Exclude stone with peeling, flaking or delaminating faces.

C. Size stone units to fit opening dimensions and perimeter conditions.

D. Clean stone prior to erection. Do not use wire brushes or implements that mark or damage exposed surfaces.

E. Clean sawn surfaces of rust stains and iron particles.

F. Wet absorptive stone in preparation for placement to minimize moisture suction from mortar.

G. Arrange stone pattern to provide color uniformity and minimize visual variations , and provide a uniform blend of stone unit sizes.

H. Provide setting and pointing mortar in accordance with Section 04 0511.
   1. If water is lost by evaporation, re-temper mortar only within two hours after mixing.

2. At ambient air temperature 80 degrees F and above, use mortar within two hours after mixing; at ambient air temperature below 50 degrees F, use mortar within two-and-one-half hours after mixing.

I. Fill dowel holes in stone units with mortar.

J. Arrange stone coursing in running bond with consistent joint width.

K. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

3.05 REINFORCEMENT AND ANCHORAGE - ANCHORED VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place horizontal joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Embed wall ties in masonry back-up to bond veneer to back-up at minimum of one for every 2-2/3 sq ft.

F. In addition, place wall ties at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings.

G. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.06 JOINTS - ANCHORED VENEER

A. Leave the following joints open for sealant specified in Section 07 9200:
1. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
2. Joints in projecting units.
3. Joints between rigidly anchored units, including soffits, panels, and column covers.
4. Joints below lugged sills and stair treads.
5. Joints below ledge and relieving angles.
6. Joints labeled "expansion joint".

B. Rake out mortar joints 5/8 to 3/4 inch and brush joints clean to accommodate pointing mortar. Fill joints with pointing mortar.

C. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.

D. At joints to be sealed, clean mortar out of joint before it sets. Brush joints clean.

3.07 INSTALLATION - ADHERED VENEER

A. Install thin stone veneer with a cementitious mortar setting bed to a backing surface, in accordance with stone fabricator's instructions and applicable sections of the ICC (IBC), TMS 402/602 and ASTM C1242 that apply to adhered masonry veneer.

B. Mortar Joints: Concave.
1. Style: Match full size unit.

C. Pattern Bond:
1. Lay out work in advance and distribute color range of stone uniformly over total work area.
2. Lay stone with face exposed.
3. Take care to avoid concentration of any one color to any one wall surface.
4. Maintain approximate 3/8 inch joint, as stone allows.
5. Do not use stacked vertical joints.

D. Windows, Doors and Wall Openings: Extend field stone units to edges of wall openings.

E. Sills: Install sills where located on drawings.

F. Caps: Install capstones where located on drawings.

3.08 INSTALLATION - MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Extend metal flashings through exterior face of stone and terminate in an angled drip with hemmed edge.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.09 CONTROL AND EXPANSION JOINTS

A. Form joints as detailed on drawings.

3.10 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

3.11 CLEANING

A. Remove excess mortar as work progresses, and upon completion of work.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.12 PROTECTION

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

END OF SECTION

SECTION 04 7200
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Masonry Mortaring and Grouting: Mortar for setting cast stone.

B. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 04 4313 - Stone Masonry Veneer.

D. Section 07 9005 – Joint Sealers.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2019.

E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

L. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Test results of cast stone components made previously by the manufacturer.
   1. Include one copy of ASTM C1364 for Architect's use.

C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
   1. Cast stone and anchors shall be designed and stamped by a professional engineer in the State of Texas.

2. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

D. Mortar Color Selection Samples.

E. Verification Samples: Pieces of actual cast stone components not less than 12 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

F. Full-Size Samples, For Review:
1. Basic Shapes: One of each.
2. Accent, Trim and Specialty Shapes: One of each.

G. Source Quality Control Test Reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.06 MOCK-UP

A. Provide full size cast stone components for installation in mock-up of exterior wall.

B. See Section 01 4000 - Quality Requirements for additional requirements.
1. Approved mock-up will become standard for appearance and workmanship.
2. Mock-up may remain as part of the completed work.
3. Remove mock-up not incorporated into the work and dispose of debris.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
1. Any current producer member of the Architectural Precast Association.

2. Any current producer member of the Cast Stone Institute.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural stone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Cast Stone Color: Reference Section 01 6210 – Schedule of Materials and Colors.
   5. Color Variation:
      a. Viewing Conditions: Compare in direct daylight at 10 feet, between components of similar age, subjected to comparable weathering conditions.
      b. Maximum Variation, ASTM D 2244:
         1) Hue: 2 units.
         2) Lightness, Chroma, and Hue Combined: 6 units.
   6. Cure units in a warm, moist curing chamber at 95% relative humidity in totally enclosed curing room under dense fog and water-spray for 24 hours.
   7. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Inset Letters:
   1. Refer to plans for copy.
   2. Paint all inset letters flat black.

D. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
   1. Pieces More than 24 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.

E. Admixtures: ASTM C494/C494M.
   1. All units shall contain a manufacturer approved integral water repellent admixture at the time of manufacture.

F. Water: Potable.

G. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

I. Embedded Anchors, Dowels, and Inserts: ASTM A 123/A 123M hot-dip galvanized steel, of type and size as required for conditions.

J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

K. Mortar: Portland cement-lime, as specified in Section 04 0511 ; do not use masonry cement.

L. Sealer: Provide a weather/graffiti protectant to interior and exterior cast stone units as specified in Section 07 1900 - Water Repellents

M. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.

C. Surface Preparation
1. Clean substrates.
2. Wet down or wash dry, dusty surfaces and remove excess water immediately prior to application of cast stone.
3. Prepare surfaces in strict accordance with manufacturer’s instructions.
4. Scarify concrete substrates with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials. Clean and maintain substrate in condition required by setting material manufacturer.
5. Do not seal substrate unless required by manufacturer.
6. Prime substrate when required by manufacturer.

D. Mechanically anchor cast stone units indicated; set remainder in mortar.

E. Setting:
1. Drench cast stone components with clear, running water immediately before installation.
2. Set units in a full bed of mortar unless otherwise indicated.
3. Fill vertical joints with mortar.
4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
1. Rake mortar joints 3/4 inch for pointing.
2. Remove excess mortar from face of stone before pointing joints.
3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
   a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.

b. Joints in projecting units.
c. Joints between rigidly anchored units, including soffits, panels, and column covers.
d. Joints below lugged sills and stair treads.
e. Joints below ledge and relieving angles.
f. Joints labeled "expansion joint".

B. Installation Tolerances:
1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Architect 's approval.

3.05 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
1. Wet surfaces with water before applying cleaner.
2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
3. Remove cleaner promptly by rinsing thoroughly with clear water.
4. Do not use acidic cleaners.

3.06 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joist Framing.

B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

F. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel 2013 (Reapproved 2018).

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

J. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric) 2021a.

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2022.

L. 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.

M. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.

N. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film 2017.

O. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.

P. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry 2018.

Q. ASTM E709 - Standard Guide for Magnetic Particle Testing 2021.

R. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

S. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.

T. 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.

U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

V. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

W. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

X. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

Y. SSPC-SP 3 - Power Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Connections not detailed.

3. Indicate cambers and loads.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

E. 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.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Erector: Company specializing in performing the work of this section with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

F. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

G. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

I. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.

J. Headed Anchor Rods: ASTM F1554 Grade 36, plain.

K. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.

2. Minimum Compressive Strength at 28 Days: 5000 pounds per square inch.

3. Height Change, Plastic State; when tested according to ASTM C827/C827M:

a. Maximum: Plus 4 percent.

b. Minimum: Plus 1 percent.

L. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 2.0 oz/sq ft galvanized coating.

2.04 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.

B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 1200

SECTION 05 2100
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.

B. Section 05 1200 - Structural Steel Framing: Superstructure framing.

C. Section 05 3100 - Steel Decking: Bearing plates and angles.

D. Section 05 3100 - Steel Decking: Support framing for openings less than 18 inches in decking.

E. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

E. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric) 2021a.

F. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film 2017.

G. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.

H. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry 2018.

I. ASTM E709 - Standard Guide for Magnetic Particle Testing 2021.

J. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

K. 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.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

P. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders 2020.

Q. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders 2008.

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

S. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. 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.

D. Fabricator's Qualification Statement.

E. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings 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. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

1. Maintain one copy of document on site.

C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

F. Erector Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws
2. Nucor-Vulcraft Group: www.vulcraft.com.
3. New Millennium. www.newmil.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
4. Finish: Shop primed.

B. Open Web Joists: SJI 100 Type DLH Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
4. Finish: Shop primed.

C. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

D. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

F. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Drill holes in chords for attachment of wood nailers where indicated.

B. Space stud shear connectors on top of top chords at 16 inches on center.

2.04 FINISH

A. Shop prime joists as specified.

1. Do not prime surfaces that will be fireproofed.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.05 SOURCE QUALITY CONTROL

A. Provide shop testing of steel components as follows:

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches.

F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

H. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 2100

SECTION 05 3100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.

B. Composite floor deck.

C. Supplementary framing for openings up to and including 18 inches.

D. Bearing plates and angles.

E. Stud shear connectors.

F. Acoustical insulation in roof deck flutes.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.

B. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.

C. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

D. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.

E. Section 05 2100 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.

F. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel 2020.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

J. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems 2022.

K. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements 2019, with Editorial Revision (2021).

L. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Cellular Floor Deck Electrical Raceway System: Coordinate the work with other trades to provide electrical service fittings compatible with the raceway system to be installed.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Submit manufacturer's installation instructions.

E. 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.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.06 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints 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. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:

1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. Cordeck, Inc: www.cordeck.com.
3. Nucor-Vulcraft Group: www.vulcraft.com.
4. New Millennium. www.newmil.coom.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.

1. Calculate to structural working stress design and structural properties specified.
2. Maximum Vertical Deflection of Floor Deck: 1/360 of span.
3. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
4. Maximum Vertical Deflection of Form Deck: 1/360 of span.
5. Maximum Lateral Deflection of Diaphragms: 1/500 of the height of the wall.

B. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Structural Properties:
   a. Span Design: Multiple.
3. Minimum Base Metal Thickness: See Drawings.
4. Nominal Height: 1-1/2 inch.
5. Profile: Fluted; SDI B.
6. Formed Sheet Width: 36 inch.
7. Side Joints: Lapped, mechanically fastened.
8. End Joints: Lapped, See Drawings.

C. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2. Span Design: Double.
3. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch.
4. Nominal Height: 1-1/2 inches.
5. Profile: Fluted; SDI WR.
6. Formed Sheet Width: 36 inch.
7. Side Joints: Lapped, mechanically fastened.
8. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

B. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.

C. Welding Materials: AWS D1.1/D1.1M.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
2. Material: Steel; ASTM A510/A510M.
    a. Hardness: Rockwell C 54.5, minimum.
    b. Tensile Strength: 285 kips per square inch, minimum.
    c. Shear Strength: 175 kips per square inch, minimum.
    d. Washers:
        1) Steel Bar Joist Framing Applications: 0.472 inch diameter, minimum.
    e. Corrosion Resistance:

F. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.

3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

4. Products:

a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

G. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

I. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

C. Floor Drain Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods indicated on drawings.

1. Welding: Use fusion welds through weld washers.

E. At mechanically fastened male/female side laps fasten at 12 inches on center maximum.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. At welded male/female side laps weld at 18 inches on center maximum.

H. Weld deck in accordance with AWS D1.3/D1.3M.

I. At deck openings from 6 inches to 18 inches in size, provide 2 by 2 by 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

J. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as specified in Section 05 1200.

K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

L. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

M. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

N. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

O. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

P. Weld stud shear connectors through steel deck to structural members below.

Q. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION 05 3100

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Exterior wall sheathing.

C. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.

B. Section 07 9200 - Joint Sealants.

1.03 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.04 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. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.

G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016, with Editorial Revision (2021).

I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

E. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout.

2. Describe method for securing studs to tracks and for screw framing connections.

F. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

G. Installation Drawings: Indicate dimensioned locations of cold-formed steel structural framing.

1. Include materials, corrosion protection, base steel thickness, and dimensions.

1.07 QUALITY ASSURANCE

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.08 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.

C. Mock-Up Size: As indicated on drawings.

D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:

1. CEMCO: www.cemcosteel.com.
2. ClarkDietrich: www.clarkdietrich.com.
3. Jaimes Industries: www.jaimesind.com.
4. MarinoWARE: www.marinoware.com/#sle.
5. SCAFCO Corporation: www.scafco.com.
6. Steel Construction Systems: www.steelconsystems.com.
7. The Steel Network, Inc: www.SteelNetwork.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Connectors:

1. Same manufacturer as metal framing.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with requirements for Contractor's design-related professional design services indicated in Section 01 4000 - Quality Requirements.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
2. Provide components fabricated from ASTM A1011/A1011M Designation SS (structural steel).
3. Products:
   a. MarinoWARE; StudRite: www.marinoware.com/#sle.
   b. MarinoWARE; Structural Framing: www.marinoware.com/#sle.
   c. MBA Building Supplies; Structural Studs & Track: www.mbastuds.com/#sle.
   d. Super Stud Building Products, Inc; SuperMAXX Studs: www.buysuperstud.com/#sle.

e. Substitutions: See Section 01 6000 - Product Requirements.

B. Jamb Studs: AISI S240; manufactured, engineered, c-shaped with wide flanges, designed to replace conventional double-stud framing at openings.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Thickness and Depth: Depth as indicated on drawings; thickness and structural grade as required to meet specified design criteria.

4. Thickness and Depth: As scheduled.

5. Thickness and Depth: As indicated on drawings.

6. Thickness: 33 mils, 0.0329 inch.

7. Products:

a. SCAFCO Corporation; Kwik-Jamb Studs: www.scafco.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

C. Headers: AISI S240; manufactured, engineered one-member or two-member assemblies, with wide flanges, designed to replace conventional box or nested header framing at openings.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Thickness and Depth: Depth as indicated on drawings; thickness and structural grade as required to meet specified design criteria.

4. Thickness: 33 mils, 0.0329 inch.

5. Jamb Mounting Clips: Manufacturer's standard.

6. Cripple Stud Clips: Manufacturer's standard.

7. Products:

a. SCAFCO Corporation; HD Header: www.scafco.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

D. Joists: AISI S240; manufactured, engineered open-web steel joists.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Thickness and Depth: As indicated on drawings.

4. Products:

    a. MarinoWARE; JoistRite: www.marinoware.com/#sle.

    b. Super Stud Building Products, Inc; SuperMAXX Joists: www.buysuperstud.com.

    c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 LATERAL FORCE-RESISTING SYSTEMS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

B. CONNECTIONS

1. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

2. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

    a. Structural Grade: As required to meet design criteria.

    b. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

4. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.

    a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

    b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

    c. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 10 feet.

    d. Products:

        1) ClarkDietrich; Drift FastClip Slide Clip D-FCSC: www.clarkdietrich.com.

        2) ClarkDietrich; FastClip Slide Clip FCSC: www.clarkdietrich.com.

3) MarinoWARE; Slotted Track: www.marinoware.com/#sle.

4) MBA Building Supplies; Slotted Track: www.mbastuds.com.

5) Simpson Strong Tie: www.strongtie.com.

6) Super Stud Building Products, Inc; Deflection Clips: www.buysuperstud.com.

7) Substitutions: See Section 01 6000 - Product Requirements.

5. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

a. Products:

1) Simpson Strong Tie: www.strongtie.com.

2) Substitutions: See Section 01 6000 - Product Requirements.

6. Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connectors where indicated on the drawings.

7. Products:

a. ClarkDietrich; Spazzer 5400 Bridging Bar: www.clarkdietrich.com/#sle.

b. ClarkDietrich; FastBridge Clip: www.clarkdietrich.com/#sle.

c. Simpson Strong-Tie; SUBH Bridging Connector: www.strongtie.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

1. Products:

a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

B. Anchorage Devices: Powder actuated.

2.07 SHEATHING

A. Glass-mat-faced gypsum board; ASTM C1177/C1177M, square long edges, 5/8 inch thick, Type X - fire-resistant.

2.08 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

D. Water-Resistive Barrier: ICC-ES AC38 Grade D and 60-minute plastic sheet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

A. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

B. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

C. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

D. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

E. Install intermediate studs above and below openings to align with wall stud spacing.

F. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

G. Attach cross studs to studs for attachment of fixtures anchored to walls.

H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

I. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 INSTALLATION OF JOISTS

A. Place joists at 16 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

B. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

C. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

D. Provide web stiffeners at reaction points.

E. Touch-up field welds and damaged galvanized surfaces with primer.

3.05 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges, and ends.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide material verification inspections in accordance with requirements of AISI S240.

3.07 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION 05 4000

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

F. Section 05 5100 - Metal Stairs.

G. Section 05 5133 - Metal Ladders.

H. Section 05 5213 - Pipe and Tube Railings.

I. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

H. 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; 2017.

I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

N. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Design miscellaneous steel and iron under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: Shapes, bar and plate shall conform to ASTM A 36/A 36M. Light gauge structural steel shall conform to ASTM A924, latest revision. All material shall be straight, free from mill scale, rust, pitting and dents that will detract from finished appearance when painted.

B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

H. Sheet Metal shall be open hearth, full pickled, cold rolled, annealed, patent leveled, entirely free from scale, waves and other defects.

I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, galvanized to ASTM A153/A153M where connecting galvanized components.

J. Rivets shall conform to ASTM A-141, latest revision.

K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

L. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

M. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. All workmanship must be first-class in all respects and any members not presenting a finished and workmanlike appearance will be rejected. All finished members shall be free from twists, bends and open joints. Work shall conform to all applicable requirement of AISC.

B. All members shall be true to length so that assembly may be done without fillers, except where same are required as detailed. There shall be no projecting edges or corners where different members are assembled. On exposed surfaces, welds shall be ground smooth and flush with parent metal. All coping, blocking or mitering shall be done with care. Sharp edges and corners caused by shearing or other tooling shall be eased where exposed.

C. All details and connections shall be close fitting and carefully made and fitted, and special care shall be exercised to produce a thoroughly neat and workmanlike appearance. All detail pieces shall be made in exact accordance with Detail Drawings with all projecting corners clipped and all filler pieces made flush. Provide all lugs, clips, connections, bolts, etc., necessary to complete fabrication and erection.

D. Unless otherwise shown on Drawings, all bolts remaining in the finished, exposed work shall have countersunk heads; nuts shall be hexagonal. Bolts shall be of proper length to permit full thread in the nut, but shall not project more than 1/4" beyond the face of the nut. Screws shall be countersunk Phillips head.

E. The Contractor shall provide all holes in his work required for the connection of the work of other trades.

F. There shall be no flame cutting of members in the field without the consent of the Architect. If consent is given, burned flame cut members shall be finished to an acceptable appearance that shall be equal of a sheared finish.

G. Burning shapes to length in the shop with a standard flame cutting machine will be permitted. Burning of holes will NOT be permitted in the shop or in the field.

H. Anchors for frames, floor angles and other miscellaneous iron members shown anchored into concrete or masonry shall be strap iron, bent to shape, or deformed bent bars welded to backs of members, extended with bent end for building in as conditions required and of sizes and spacing as noted. Where the size and spacing are not noted, anchors shall not be less than 1-1/2" x 1/4" for concrete and 1-1/2" x 1/8" for masonry to fit the jointing of the adjacent brick or masonry block work. Unless otherwise noted on the Drawings, anchors shall be spaced 3'-0" or less o.c.

I. Where anchors and plates or clips are to be built in for attachment of later work, bolts shall be placed in the plates or clips and welded to back with threaded ends extended as required.

J. For attaching work to masonry or concrete, where anchors or inserts cannot be built-in, provide approved type of cinch anchors and machine bolts or screws. Holes shall be accurately drilled.

K. Fit and shop assemble items in largest practical sections, for delivery to site.

L. Fabricate items with joints tightly fitted and secured.

M. Continuously seal joined members by intermittent welds and plastic filler.

N. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

O. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

P. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, prefabricated or hand formed crowned cap, or as detailed; prime paint finish.

B. Downspout Boots shall be fabricated from 16 gauge galvanized steel and field painted to match downspouts. See drawings for details.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.

D. Lintels: As detailed; prime paint finish.

E. Door Frames for Overhead Door Openings and Wall Openings: Channel and Angle sections; prime paint finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

G. All steel exposed to weather, set in concrete shall be painted with cold galvanized zinc, specification of U.S. Navy MIL-P-21035, U.S. Air Force MIL-P-26915A, equal to Hot Dip galvanized in cathodic protection.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall examine the construction to which his work is to be applied and shall notify the Architect in writing if deficiencies exist which are detrimental to the proper and timely installation of any work required under this section.

3.02 PREPARATION

A. The contractor shall examine the drawings and specifications with respect to the work shown or required under this section and related sections so as to insure the completeness of all work. Supplementary parts necessary to complete each item of miscellaneous iron and steel required under this section, such as bent plates, beams, columns, sleeves, clips, brackets, hangers, anchors, bolts and other fastenings and supports, though such parts are not shown on drawings or specified herein, shall be included.

B. The Contractor shall coordinate and schedule the work of this section with the work of other trades. Anchors, sleeves, framing, fastenings and other miscellaneous items to be embedded in concrete or masonry or required for securing miscellaneous iron and steel work to other construction, shall be furnished as required and so as not to delay the progress of the work.

C. The Contractor shall obtain field measurements of adjoining work as required to locate and fit the work of this section. He will be held responsible for the accurate fitting of his material to the building.

D. Storage and Handling: Miscellaneous steel shall be handled and delivered to the job in a manner that will prevent damage to the material. Store in a dry place, under cover, well protected from weather and all elements that will cause deterioration.

E. Clean and strip primed steel items to bare metal where site welding is required.

F. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects. All parts shall be secured in a rigid and substantial manner and methods or attachment shall be concealed wherever practicable.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

G. Other trades will set and build in items of miscellaneous iron which are to be built into masonry or concrete, such as loose lintels, seat angles, door frames, curbs, sleeve inserts, brackets, lugs, anchors, etc. as required to complete all parts of the work.

H. All such items shall be fabricated and delivered by the miscellaneous iron trade, complete with bolts, anchors, clips, etc., ready for the other trades to set. This trade shall consult with the trades concerned and make delivery to the points designated by the latter to expedite the installation of delivered materials in their current locations and shall furnish setting drawings where required.

I. Where frames, curbs, and similar work are composed of several parts, only those parts upon which anchors occur will, unless otherwise specified, be set and built-in by the other trades ready to receive further field assembly by the miscellaneous iron contractor.

J. Where necessary to secure miscellaneous iron work to the structure by means of welding, expansion bolts, cinch anchors and similar connections, this trade shall, unless otherwise specified, do the work of laying out and installing such connections, installing the miscellaneous iron work and bolting up.

K. All other items of miscellaneous iron shall be furnished and completely installed and connections made by this trade.

L. Throughout the work of this trade, anchors and inserts shall be provided wherever possible for building in the adjoining work. Where lugs are shown or specified for building into adjoining masonry, the parts having lugs shall be erected in place before the masonry is built. Elsewhere, the work shall be brought to the building in as large pieces as practicable and attached to anchors or inserts during erection.

M. All parts of work exposed to view shall be left clean, smooth and neatly finished.

N. All freestanding steel handrails shall be embedded in the concrete slab unless noted otherwise.

O. Shelf angles and supports for masonry, etc., and slab edge plates shall be furnished and installed as shown.

P. All shelf angles shall be punched for bolts. Furnish and install bolts as required.

3.04 WELDING

A. All welding on steel, both shop and field, shall be done by the electric method in accordance with the American Welding Society specifications. Welder shall be especially skilled in this class of work and qualified by successfully passing the American Welding Society tests and have a current certificate.

B. Welds shall be solid and homogeneously a part of the metals joined and free from pits or incorporated slag and scale. Surfaces of welds shall be smooth and regular and shall be full area indicated or required to develop the required strength of the joints. Where exposed, welds shall be ground smooth and flush with the parent metal, so as to be imperceptible after painting.

C. If directed by Architect, welds, selected at random, shall be tested by an approved laboratory and any welds not complying with the specifications shall be removed and replaced with satisfactory work. The cost of test shall be borne by the Contractor in all cases in which welding fails to comply with the specifications, otherwise by Owner. The cost of replacing condemned welds, plus the cost of replacing other materials damaged incidental thereto, shall be borne by the Contractor.

D. Galvaweld: All welds on galvanized surfaces performed after galvanizing shall be Galvaweld coated.

3.05 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 5000 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2017.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

K. ASTM A1008/A1008M - 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; 2018.

L. 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; 2017.

M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

P. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.
   3. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

C. Design Data: As required by authorities having jurisdiction.

D. Welders' Certificates.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Texas, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   2. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
      a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
      b. Welds Exposed to View: Ground smooth and flush.
      c. Mechanical Joints: Butted tight, flush, and hairline.
      d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
      e. Exposed Edges and Corners: Eased to small uniform radius.
      f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
1. Concrete Depth: 2 inches, minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum. For lengths over 5'-6" use 12 gage. Where terrazzo is used as a finish on the treads provide 10 gauge risers for all tread lengths.
4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
5. Concrete Reinforcement: Welded wire mesh.
6. Concrete Finish: Steel troweled.

D. Risers: Same material and thickness as tread pans.
1. Riser/Nosing Profile: Sloped riser with rounded nosing as specified in Section 05 5516.

E. Stringers: Rolled steel channels, HSS members, and or as indicated on drawings.
1. Stringer Depth: As indicated on drawings.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: As specified in Section 05 5213 and/or Section 05 7000. Reference drawings for locations of each ytpe where required.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.

G. Concrete Fill: Type specified in Section 03 3000.

H. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.04 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.05 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 5133
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.

B. Prefabricated ship ladders.

C. Ladder safety systems.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications

B. Section 09 9000 - Painting and Coating

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.

B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.

C. 29 CFR 1910.140 - Personal fall protection systems; Current Edition.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

E. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

F. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems; 2016.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

I. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

J. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

L. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16, and ANSI A14.3 requirements.

E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Design miscellaneous steel and iron under direct supervision of a Professional Engineer experienced in design of this work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, galvanized to ASTM A153/A153M where connecting galvanized components.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
3. Space rungs 7 inches from wall surface.

4. Comply with 29 CFR 1910.28 for fixed ladders that extend more than 24 feet above a lower level.
5. Provide ladders at elevator pit, roof hatch, floor hatch and roof-to-roof ladders where noted on the drawings or where required by code.

2.04 PREFABRICATED LADDERS

A. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
   3. Incline: 60 degrees.
   4. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
   5. Basis of Design:
      a. Ships ladder shall be equal to Model #521-10-LP as manufactured by O'Keefe's, Inc..
   6. Manufacturers:
      a. Alaco Ladder Company: www.alacoladder.com.
      b. ACL Industries, Inc: www.aclindustries.com.
      c. O'Keeffe's Inc: www.okeeffes.com/#sle.
      d. Precision Ladders, LLC: www.precisionladders.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.05 LADDER SAFETY SYSTEMS

A. Ladder Safety System: Comply with 29 CFR 1910.28 (b)(9)(i-iv), 29 CFR 1910.29, 29 CFR 1926.1053, and Section 7 of ANSI A14.3; ladder safety system allows the worker to climb up and down using both hands; does not require the employee continuously, hold, push, or pull any part of the system while climbing.
   1. Install on new fixed ladders over 24 feet in height.
   2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
   3. Flexible Carrier: Fixed 3/8 inch diameter galvanized steel wire rope lifeline with shock absorber and top, bottom and intermediate supports.
   4. Rigid Carrier: Fixed galvanized steel U-shaped slotted track with top, bottom and intermediate supports.
   5. Fall Arrester: Stainless steel and aluminum manual pass-through carrier sleeve fall arrester; compatible with carrier.

B. Personal Fall Arrest System Components; 29 CFR 1910.140:
   1. Body Support: Full body harness meeting requirements of ANSI/ASSP Z359.11; equipped with front or hip D-rings for attachment to climbing ladder fall arrest system.
   2. Connecting Means: Connecting hardware, such as a locking carabiner, meeting requirements of ANSI/ASSP Z359.12; compatible with fall arrester and body support harness.

2.06 FINISHES - STEEL

A. Prime paint steel items.
   1. Do not prime surfaces in direct contact with concrete.
   2. Do not prime surfaces where field welding is required.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Install ladder safety system in accordance with manufacturer's instructions.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field weld components as indicated.

E. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair or ramp railings and guardrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.

C. Section 05 5100 - Metal Stairs: Attachment plates for handrails specified in this section.

D. Section 09 2982 - Gypsum Board: Placement of backing plates in stud wall construction.

E. Section 09 9000 - Painting and Coating: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

C. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

D. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Texas, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings Accessories:
   1. C.R. Laurence Co., Inc., Blumcraft: www.crl-arch.com.
   2. Julius Blum & Company: www.juliusblum.com.
   3. The Wagner Companies, Braun: www.wagnercompanies.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout:
   1. W.R. Meadows: EG-96 HP
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Design railing assembly, wall rails, and attachments to resist lateral force of 250 lbs at any point without damage or permanent set as required by OSHA, the Local Building Code and Texas Accessibility Standards. Test in accordance with ASTM E 935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Provide non-expansive epoxy grout (mounding up) all around and under each vertical pipe. No gypsum based grout allowed.

E. Handrail Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
   2. Intermediate Rails: 1-1/2 inches diameter, round.
   3. Posts: 1-1/2 inches diameter, round at 4'-0" on center.
   4. Balusters: 3/4 inch diameter, round.

F. Guardrail Dimensions: See drawings for configurations and heights.
   1. Top Rails: 1-1/2 or 2 inches diameter, round. Reference drawing for configuration used.
   2. Intermediate Rails: 1-1/2 inches diameter, round.
   3. Posts: 1-1/2 or 2 inches diameter, round. Reference drawing for configuration used.
      a. 1-1/2" post shall be at 2'-0" on center.
      b. 2" post shall be at 4-0" on center.
   4. Balusters: 3/4 inch diameter, round.

G. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. For anchorage to stud walls, provide backing plates, for bolting anchors.
   4. Posts: Provide adjustable flanged brackets.

H. Provide mechanical and welding fittings where indicated to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

C. Brackets and Accessories
   1. For wall mounted handrail brackets for steel handrails provide and install wall brackets equal to J.G. Braun #4591. Provide handrail returns equal to J.G. Braun 1100-1.
   2. For wall mounted handrail brackets for wood handrails provide and install Julius Blum #29 stainless two-piece wall bracket.

D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

F. Straight Splice Connectors: Steel concealed spigots.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by continuous welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete, embedded in masonry, or placed in partitions with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. At each vertical post set in concrete cores, provide non-expansive epoxy grout. No gypsum based grout allowed.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/8 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/8 inch.

C. Maximum Out-of-Position: 1/8 inch.

END OF SECTION

SECTION 05 5516
METAL STAIR NOSINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior Cast-in-Place Stair Nosings

B. Exterior Cast-in-Place Stair Nosings

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete

B. Section 05 5100 - Metal Stairs

1.03 REFERENCE STANDARDS

A. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

B. ADAAG, Americans with Disabilities Act Accessibility Guidelines.

C. TAS, Texas Accessibility Standards

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades; including color samples.
4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.05 QUALITY ASSURANCE

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6000 - Product Requirements.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. American Safety Tread Company: www.americansafetytread.com

B. Babcock-Davis: www.babcockdavis.com.

C. Balco, Inc.: www.balcousa.com

D. Nystrom, Inc.: www.nystrom.com.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Cast-in-Place Interior Stair Nosings

1. At interior locations of concrete filled steel stair pans, stair nosings shall be a two part system, equal to type DST-330 (Type 1 Anchor) as manufactured by Balco, Inc. The base shall consist of heat treated extruded aluminum alloy 6063-T5. The abrasive filler shall consist of a mixture of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base. The abrasive ribs shall project a minimum of 1/16 inch above the extruded channels. Nosings shall be full length of steps. Color shall be as selected by the architect.

B. Exterior locations

1. At exterior locations of concrete stairs, nosings shall be a two part system, equal to type XH-330 (Type 1 Anchor) as manufactured by Balco, Inc. The base shall consist of heat treated extruded aluminum alloy 6063-T5. The abrasive filler shall consist of a mixture of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base. Nosings shall terminate not more than 1" from ends of steps for poured concrete stairs. Color shall be as selected by the architect.

2.03 ACCESSORIES

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.04 FABRICATION

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.02 INSTALLATION

A. General

1. Set work accurately into position, plumb, level, true and free from rack.
2. Anchor firmly into position.
3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
4. Grind exposed welds smooth and touch-up shop prime coats.
5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.04 PROTECTION

A. Protect installed Ladders from subsequent construction operations.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.
B. Structural Composite Lumber
C. Sheathing.
D. Roofing nailers.
E. Roofing cant strips.
F. Preservative treated wood materials.
G. Fire retardant treated wood materials.
H. Miscellaneous framing and sheathing.
I. Concealed wood blocking, nailers, and supports.
J. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
C. Section 07 2500 - Weather Barriers
D. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.

1.03 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 D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.
F. PS 1 - Structural Plywood; 2009.
G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
H. PS 20 - American Softwood Lumber Standard; 2020.
I. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, application instructions, and vendor.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. Samples: For rough carpentry members that will be exposed to view, submit three samples, 12by12 inch in size illustrating wood grain, color, and general appearance.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
   1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
   2. Identify plywood sheathing as to grade, use, span rating and exposure classification by the mark of the APA The Engineered Wood Association.
   3. Use extreme care when off-loading lumber to prevent damage, splitting and breaking of materials. Split or broken plywood sheathing will not be accepted for use in the work of this Section.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: 19 percent maximum.

D. Stud Framing (2 by 2 through 2 by 6):
   1. Species: Any allowed under referenced grading rules.
   2. Grade: No. 2.

E. Joist and Rafter Framing (2 by 6 through 4 by 16):
   1. Species: Spruce-Pine-Fir (South).
   2. Grade: No. 2.

F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: No. 2 or Standard Grade.

2.03 STRUCTURAL COMPOSITE LUMBER

A. System Description
   1. Design Requirements: Design gate system to withstand Miami/Dade County 110 MPH steady wind and 130 MPH gusting wind tests.

B. Warranties
   1. Furnish manufacturer's 10-year warranty providing coverage against checking, splitting, splintering, rotting, structural damage from termites and fungal decay of composite wood.

C. Materials
   1. Composite Wood:
      a. Reclaimed wood and plastic with integral coloring; free from toxic chemicals and preservatives.

D. Components
   1. Gate System: as detailed on the drawings.
      a. Components:
         1) Pickets
         2) Top and bottom rails.
         3) Bottom rail inserts.
      b. Surface texture: Smooth.
      c. Color: as selected by Architect.

E. Accessories
   1. Fasteners: Galvanized or corrosion-resistant coated steel.
   2. Provide stainless steel where used at fire retardant or pressure treated wood.

F. Manufacturers:
   1. Trex Company: www.trex.com
   2. iLevel by Weyerhaeuser: www.ilevel.com.
   3. Boise Cascade: www.bc.com.
   4. Georgia-Pacific Corp.: www.gp.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.04 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: S-dry (19 percent maximum).

C. Surfacing: S4S.

D. Species: Douglas Fir.

E. Grade: No. 2, 2 Common, or Construction.

2.05 CONSTRUCTION PANELS

A. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exposure 1.
   2. Span Rating: 40/20.
   3. Thickness: 5/8 inch, nominal for standing seam metal roofs, 2 layers of 3/8 inch, nominal for curved standing seam metal roofs and 3/4 inch for asphalt shingle roofs.
   4. Provide metal clip supports between sheets

B. Other Applications: Thickness as noted on the drawings
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.06 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, stainless steel for fire retardant treated locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

B. Fasteners at Roof Nailers:
1. Wood Substrate: #10 stainless steel flat head screws, length as necessary to penetrate underlying wood support members a minimum of 1 1/4 inch. Each fastener to have a minimum pull out resistance of 100 pounds.
a. Bent plate for attaching vertical lumber at curbs: 18 gauge galvanized steel (G90) bent plate, fastened with stainless steel pancake head screws.
2. Metal Substrate: No. 12 Factory Mutual approved, fluorocarbon coated roofing screw.
3. Concrete or masonry surfaces: Series 400 stainless steel anchor with expansion shank, length as recommended by manufacturer for minimum 1,000 pound pull-out resistance.
4. Lightweight Fill Substrate: OMG Lite-Deck Fasteners (or approved equivalent) #TSFQ4, minimum length sufficient to provide manufacturer’s minimum embedment into substrate for published resistances.
a. Shank diameter 0.312” minimum, thread diameter of 0.375” minimum.
b. Fastener shall be coated with a corrosion resistant coating. When subjected to 30 Kesternich cycles (DIN 50018),the fastener must show less than 15% red rust and surpass Factory Mutual Approval Standard 4470.

C. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

D. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

E. Water-Resistive Barrier: As specified in Section 07 2500.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Treat all exterior rough carpentry items.
c. Do not use treated wood in direct contact with the ground.

2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber exposed to weather.
   c. Treat lumber in contact with roofing, flashing, or waterproofing.
   d. Treat lumber in contact with masonry or concrete.
   e. Treat lumber in other locations as indicated.
2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   b. Treat plywood in contact with roofing, flashing, or waterproofing.
   c. Treat plywood in contact with masonry or concrete.
   d. Treat plywood in other locations as indicated.
3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
   a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
   b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.

E. Install horizontal spanning members with crown edge up and not less than 3 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span at mid-span. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.
1. Install new wood where indicated to provide total height of a minimum of 12 inches above the finished roof surface, allowing for height of insulation system, crickets, and coverboard, as applicable.
2. Fasten securely to substrate.
3. Treat surfaces exposed by cutting as recommended by preservative manufacturer.

4. Fasten wood curb to nailer prior to installation with appropriate wood nailer fastener on 12-inch centers.

C. Secure all roof nailers at copings and edges with two staggered rows of fasteners, spaced 12" o.c. maximum at wood or light gauge steel substrates, and 24" o.c. maximum at concrete, grouted masonry, or structural steel substrates.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
1. Comply with "Code Plus" provisions of above-referenced guide.

B. Comply with system manufacturer's written instructions for installing plywood.
1. Install plywood sheathing continuously, with the strength of the axis of the panel across supports. Plywood sheathing shall be installed with offset joints. Butt end joints over supports, providing a space of 1/16" at panel ends and 1/8" at panel edges.
2. Fasten each layer of plywood sheathing using #13-14 Dekfast screws with Phillips drive truss heads in a noncorrosive base material in sufficient length to penetrate the metal decking by 1/2". Use a screw pattern of 6" spacing along exterior edges and a 12" interior grid pattern per UL90 class 580 uplift. Provide a minimum of 32 fasteners per sheet. Plywood shall be fastened as an independent system for the insulation. Where drawings indicate multiple layers of plywood, stagger second layer in both directions from pattern below. At curved roof structures, plywood shall conform to the radius of the structure.
3. Within 40 feet in any direction of any 4-hour firewall, install fire-retardant treated plywood sheathing.
4. Provide metal clip supports between sheets at center spans unless tongue and groove plywood sheathing is used.
5. Cover plywood sheathing as soon as possible with specified underlayment for protection against excessive moisture prior to roofing application.
6. Do not install plywood sheathing in adverse weather conditions. Plywood sheathing may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, crook, mildew, fungus, or mold as well as for improper curing and firming prior to installation. Wet or damaged plywood sheathing will be rejected.

3.07 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.08 TOLERANCES

A. Framing Members: 1/8 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 3/8 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.09 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7000.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.

B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 08 1416 - Flush Wood Doors.

C. Section 09 9000 - Painting and Coating: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0; 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of finish plywood, 6 by 6 inch in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 6 inches long.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: As detailed on the drawings.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: As noted on the drawings, with a maximum moisture content of 6 percent, of quality suitable for transparent finish.

2.03 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, plain sawn, book matched, veneer core, glue type as recommended for application.

B. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

C. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/4 inch thick, with holes spaced at 1 inch on center in both directions.

2.04 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fastening:
   1. Install items straight, true, level, plumb, and firmly anchored in place.
   2. Where blocking or backing is required, coordinate as necessary with other trades to ensure placement of required backing and blocking in a timely manner.
   3. Nail trim with finish nails of proper dimension to hold the member firmly in place without splitting the wood.
   4. Nail exterior trim with galvanized nails, making joints to exclude water and setting in waterproof glue or the sealant described in Section 07 9200 - Joint Sealants of these Specifications.

2.05 FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and Section 09 9000-Painting and Coating.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with nails at 8 inch on center.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9000.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 8316
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010, with Editorial Revision (2015).

B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.

C. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

E. FM 4880 - Approval Standard for Class 1 Fire Rating of Building Panrels or Interior Finish Materials; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, 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. Samples: Submit two samples 8 by 10 inch in size illustrating material and surface design of panels.

D. Submit Material Safety Data Sheets for the following items:
   1. All mastics, glues and adhesives
   2. Sealant (interior use only)

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Crane Composites, Inc: www.cranecomposites.com/#sle.
   2. Marlite, Inc: www.marlite.com/#sle.
   3. Nudo Products, Inc: www.nudo.com/#sle.
   4. Panolam Industries International, Inc: www.panolam.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

A. Wall Panels at drywall partitions behind service sinks:
   1. Panel Size: 4 by 8 feet.
   2. Panel Thickness: 0.075 inch.
   3. Surface Design: Smooth.
   4. Color: White.
   5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Class 1 fire rated when tested in accordance with FM 4880.
   3. Scratch Resistance: Barcol hardness score greater than 50, when tested in accordance with ASTM D2583.
   4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 1900
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior cast stone masonry surfaces.

1.02 RELATED REQUIREMENTS

A. Section 04 7200 – Cast Stone Masonry.

B. Section 07 9200 – Joint Sealants.

1.03 REFERENCE STANDARDS

A. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).

B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2013).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, limitations, and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.07 MOCK-UP

A. Locate where directed.

B. Accepted mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. Diedrich Technologies: www.diedrichtechnologies.com
   2. PROSOCO, Inc: www.prosoco.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: 1 or 2 coats as recommended by the manufacturer.
   3. VOC Content: Less than 100 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
   4. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
      a. Basis of Design: Sure Klean Weather Seal Siloxane PD.
      b. Apply with low-pressure spray, brush or roller.
      c. Typical Technical Data:
         1) Form: cloudy white liquid, odorless
         2) Specific Gravity: 0.996
         3) pH: 4 to 5
         4) Weight/Gallon: 8.29 pounds
         5) Active Content: 7 percent
         6) Total Solids: 4 percent ASTM D5095
         7) Flash Point: greater than 212 degrees F (greater than 100 degrees C) ASTM D 3278
         8) Freeze Point: 32 degrees F (0 degrees C)
         9) VOC Content: less than 30 grams per Liter, Low Solids Coating.
      d. Locations: Apply at exterior and interior cast stone.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

F. Scrub and rinse surfaces with water and let dry.

G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

D. Provide manufacturer's field service representative to inspect preparation and application work to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at masonry cavity wall construction and exterior wall behind masonry veneer, MCM and metal panel wall finish.

B. Batt insulation in exterior wall construction.

C. Semi-Rigid Board/Blanket insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

D. Acoustical batt insulation for interior walls and above ceilings.

E. Mineral wool insulation for fire safing.

1.02 RELATED REQUIREMENTS

A. Section 07 2200 - Roof and Deck Insulation: Insulation specified as part of roofing system.

B. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

C. Section 09 2982 – Gypsum Board.

D. Section 09 5100 – Acoustical Ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

G. BIA - The Brick Industry Association; Tech Note on Brick Construction, 28B Revised II.

H. ICC (IECC) - International Energy Conservation Code 2015.

I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation that proposed insulation has been successfully tested per NFPA 285 with each specific exterior wall assembly for the project. Provide documentation of required detailing for proposed insulation board at openings in the exterior walls to comply with NFPA 285 requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. Closeout Submittals:
   1. Submit under provisions of Section 01 7800 – Closeout Submittals
   2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Procedures for the following items:
      a. All mastics, glues, and adhesives.
      b. Thermal insulation (excluding fiberglass, foam, rubber).

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides, installed on masonry wall, behind MCM or metal wall panels where indicated: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1 or 2.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of core foam.
         1) Class 1 or Class 2 - Glass fiber reinforced or non-reinforced core foam.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   5. Compressive Strength: 25 psi at vertical locations.
   6. Board Size: 48 by 96 inch, cut to fit locations indicated. Thickness as noted on the drawings.
   7. Thermal Resistance: R-value of 6.0 per inch, minimum.
   8. Board Edges: As tested to be in compliance with NFPA 285.
   9. Manufacturers:
      a. Atlas Roofing Corporation: www.atlasroofing.com/sle.
      b. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/sle.
      c. Dow Chemical Company: www.dow.com/sle.
      d. Firestone Building Products: www.firestonebpco.com.
      e. GAF: www.gaf.com/sle.
      f. Hunter Panels, LLC: www.hunterxci.com.
      g. Johns Manville: www.jm.com/sle.
      h. Ox Engineered Products: www.oxengineeredproducts.com/#sle.
      i. Rmax Inc: www.rmax.com.
      j. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIBERBOARD INSULATION MATERIALS

A. Glass Fiber Semi-Rigid Board/Blanket Insulation: Low density board, in accordance with ASTM C553, Type III.
   1. Provide in shim spaces, crevices in exterior wall/roof and expansion joints as detailed on the drawings.
   2. Facing: None, unfaced.
   3. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
   4. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
   5. Board Size: 24 by 48 inch.
   6. Board Thickness: 1 inch.

7. Board Edges: Square.
8. Maximum Density: 1.6 pounds per cubic foot, nominal.
9. Manufacturers:
    a. CertainTeed Corporation: www.certainteed.com.
    b. Johns Manville: www.jm.com.
    c. Knauf Insulation: www.knaufnorthamerica.com
    d. Owens Corning Corporation: www.ocbuildingspec.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
    1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
    2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
    3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
    4. Formaldehyde Content: Zero.
    5. Thermal Resistance: R-value of 11.0 at 3.5" and 19.0 at 6".
    6. Facing: Unfaced.
    7. Manufacturers:
        a. CertainTeed Corporation: www.certainteed.com.
        b. Johns Manville: www.jm.com.
        c. Knauf Insulation: www.knaufnorthamerica.com
        d. Owens Corning Corporation: www.ocbuildingspec.com/sle.
        e. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Batt Insulation:
    1. Provide sound attenuation batts within interior walls and above ceilings, where indicated.
    2. Glass fiber composition, unfaced.
        a. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
        b. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
        c. Thickness: 3.5 or 6 inch, nominal for given location.
        d. Facing: Unfaced.
    3. Manufacturers:
        a. CertainTeed Corporation: www.certainteed.com.
        b. Johns Manville: www.jm.com.
        c. Knauf Insulation: www.knaufnorthamerica.com.
        d. Owens Corning Corporation: www.ocbuildingspec.com.
        e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FIRE SAFING INSULATION

A. Mineral Fiber Batt Insulation (Mineral Wool): Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
    1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
    2. Where indicated or required, provide as fire safing of through penetrations, joint systems and perimeter containment in rated assemblies.
    3. Size and Density: As required to prevent passage of fire between floors or through walls for rating stated.
    4. Manufacturers:
        a. Johns Manville: www.jm.com/#sle.
        b. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
        c. Thermafiber, Inc: www.thermafiber.com/#sle.
        d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Air Barrier Sheet or Air Barrier Coating: See Section 07 2500.

B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application, prohibited for use with foam or high density rigid mineral fiber insulation boards.

C. Insulation Pins: Insulation manufacturer's standard stainless steel pins with perforated plates, intended for installation in adhesive.

D. Adhesive: Type recommended by insulation manufacturer for application.
   1. Adhesives used to attach exterior insulation to air barrier shall be approved by air barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install Iboard insulation on masonry walls, behind MCM or Metal Wall Panels in accordance with fire resistance requirements shown on the drawings and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   1. Protect edges at door and window openings or other penetrations as tested in accordance with NFPA 285.
   2. Blind fastening of insulation through the air/weather barrier is prohibited. Securement of installation boards shall be provided with adhesives or furring installed at the air/weather barrier surface prior to installation of boards.

B. Install boards vertically on walls.
   1. Place boards to maximize adhesive contact.
   2. Butt edges and ends tightly to adjacent boards and protrusions. Stagger board joints.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards vertically on walls.
   1. Place boards to maximize adhesive contact.
   2. Butt edges and ends tightly to adjacent boards and protrusions. Stagger board joints.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Wall Sound Insulation: Install Insulation in all metal stud walls unless noted otherwise. Where wall continue to deck, provide sound insulation full height of wall. Do not install insulation between studs where plumbing lines occur.

F. Ceilling Sound Insulation: Install above the entirety of all offices, restrooms, and workrooms and any other areas defined on the drawings.

G. Coordinate work of this section with construction of air barrier seal specified in Section 07 2500.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2216

ROOF BOARD INSULATION

PART 1 – GENERAL

1.01 REFERENCES (INCLUDING LATEST REVISIONS)

A. Comply with governing local, state, and federal regulations, safety standards, and codes.

B. Testing Laboratory Services: Test results shall meet or exceed established standards.

C. Underwriters Laboratories, Inc. (Roofing Covering): Class A fire hazard classification.

D. American Society of Testing Materials (ASTM)
1. C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
2. C 209 Methods of Testing Insulating Board (Cellulosic Fiber), Structural and Decorative
3. C 728 Perlite Thermal Insulation Board
4. D 41 Asphalt Primer Used in Roofing and Waterproofing
5. D 312 Asphalt Used in Roofing
6. D 1621 Test Method for Compressive Properties of Rigid Cellular Plastics
7. D 4601 Asphalt Coated Glass Fiber Base Sheet Used in Roofing

E. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual

F. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI)

G. American Society of Civil Engineers - ASCE 7 Minimum Design Loads for Buildings and Other Structures (for wind uplift criteria)

1.02 QUALITY ASSURANCE

A. Regulatory Requirements
1. Classified by Underwriter's Laboratories (UL) as Class A roof covering.
2. Follow local, state, and federal regulations, safety standards, and codes.

B. Installation
1. Installation shall be in accordance with manufacturer's current published application procedures, NRCA general recommendations, and ASCE 7 wind uplift criteria.
2. Roof system manufacturer's technical specifications shall be considered part of this specification and shall be used as reference for specific application procedures.

C. Contract Documents
1. In the case of an inconsistency between the drawings and specifications or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Project Manager's/Architect's interpretation.

1.03 SUBMITTALS

A. Product Data: Submit Manufacturer's product data sheets for each product.

B. Shop Drawings: Layout of roof plan showing direction of slope, amount of slope, spot elevations indicating thicknesses at high and low points.

C. Certification: Submit roof manufacturer's certification in writing that insulation is acceptable as substrate for application of specified roof system.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufacturer's recommendations.

B. When stored outdoors:
1. Tarp and shield insulation from moisture and ultraviolet rays.
2. Elevate insulation above substrate four inches minimum.
3. Secure insulation to resist high winds.
4. Distribute insulation stored on roof deck to prevent concentrated loads that would impose excessive stress or stain on deck or structural members. Verify that structure can accommodate additional loading.
5. Wet insulation, or insulation that has been wet but which has dried, may not be used and shall be removed completely and immediately from the job site.
6. Do not double stack bundles of insulation on the roof top.

1.05 SEQUENCING AND SCHEDULING

A. Substrate Acceptance: Roof system manufacturer's representative shall inspect roof deck and associated substrates and provide written acceptance of conditions.

B. Manufacturer's approved roofing contractor shall inspect and approve deck and substrates.

C. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing.

D. Do not install more insulation than can be covered with complete roof system in same day.

1.06 PRODUCT CONDITIONS

A. Environmental Requirements:
1. Apply roofing and insulation in dry weather.
2. Do not proceed with roof construction during inclement weather or when precipitation is predicted 40% or more possibility.
3. Do not apply insulation over wet or moist deck or in foggy conditions.
4. Days with wind speeds of 30 mph or greater shall be considered "Bad Weather" days.

B. Emergency Equipment: Maintain on-site equipment and material necessary to apply emergency temporary seals in the event of sudden storms or inclement weather.

C. Costs for emergency roofing shall be borne by Contractor.

PART 2 – PRODUCTS

2.01 INSULATION – FLAT STOCK

A. 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, Underwriters Laboratory approved, and be listed in the FM Global Approval Guide.

B. Polyisocyanurate Roof Insulation: Insulation shall be two layers of rigid polyisocyanurate foam board; meeting Federal Specification No. HH-I-1972/1 or 2 with 20 psi minimum compressive strength and 2.0 pcf minimum density. First layer shall be a minimum thickness of one and one-half inch (1-1/2"). R-value over each roof area shall meet or exceed R-25. Board shall be surfaced on two (2) sides with non-asphaltic facer material.

2.02 INSULATION – TAPERED

A. Factory Tapered Polyisocyanurate Crickets: Factory cut twenty-four inch by forty-eight inch (24" x 48") polyisocyanurate board cut to one-half inch (1/2") per foot slope used in conjunction with standard thickness of polyisocyanurate board to provide positive slope.

2.03 COVER BOARD

A. Shall be impact-resistant, nonstructural, specially engineered gypsum and cellulose fiber panels with 95% recycled content; uniform water-resistance throughout core and surface. Board size four feet by four feet (4' x 4'), thickness 1/2" ; conforming to ASTM C 1278, meeting FM 4470 Class 1 criteria, classified by Underwriters Laboratories, and listed in the FM Global Approval Guide. Board will meet the following physical properties, Securock® Roof Board, as manufactured by USG Corporation, or approved equal.

Test	Typical Value	Test Method
Fire Resistance	Class A	UL 790
Permeance	≤ 30	ASTM C473
Surface water absorption	≤ 1.6 nominal grams	ASTM C473
Water resistance	Maximum 10% weight percentage gain	
Mold Resistance	Minimum rating of "10"	ASTM D3273

2.04 ASPHALT ROOF PRIMER

A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces, as manufactured by GAF, or approved equal.

Applicable Federal Specification	SS-A-701B
ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.05 BITUMEN

A. Shall be ASTM D 312 Type IV extra steep asphalt.

B. Shall be Low Fuming Perma Mop ASTM D 312-15 modified asphalt, and as acceptable by roofing manufacturer to comply with warranty requirements.

2.06 FASTENERS

Fasteners and fastening plates and/or termination bars shall be FM Approved and shall be listed in the FM Global Approval Guide, and as recommended by the insulation/fastener manufacturer for the specific application to meet the minimal requirements for wind uplift as required by the local jurisdiction and/or FM Global.

A. Heavy Duty Fastener for Steel Applications for 18-22 gauge Steel and Wood Substrates: Shall be a #14 fastener with a minimum .190 diameter shank and a thread diameter of .245 with ten (10) threads per inch and a 30 degree spade point. Fasteners shall be fluorocarbon coated with CR-10 corrosion resistant coating when subjected to 30 Kesternich cycles (DIN 50018) shows less than 15% red rust which surpasses FM Global Approval Standard 4470, as manufactured by OMG Roofing Products, or approved equal. All fasteners shall be used in conjunction with the manufacturers approved round pressure plate. Fasteners, plates, and/or bars shall be FM approved and listed in the FM Global Approval Guide.

B. Toggle Bolt: Shall be a standard or assembled toggle bolt, 2” steel plate and wing, / 3” steel plate and wing, with a major thread diameter of .250 and a head of .125, with a fluorocarbon coated, with CR-10 corrosion resistant coating. When subjected to 30 Kesternich cycles (DIN 50018) shows less than 15% red rust which surpasses FM Global Approval Standard 4470 as manufactured by OMG Roofing Products, or approved equal. Fasteners, plates, and/or bars shall be listed in the FM Global Approval Guide.

PART 3 – EXECUTION

3.01 PROTECTION OF ROOFING

A. Provide special protection from traffic on completed work.

3.02 EXAMINATION AND PREPARATION

A. Do not install until defects are corrected and deck substrate meets roof system manufacturer's requirements.

B. Do not apply insulation unless asphalt application temperature, EVT of approximately 375° F to 425° F, can be maintained or when water or moisture is present on substrate. Do not heat asphalt above flashing point, or 525° F.

C. Examine substrate and related surfaces, and verify that there are no conditions such as inadequate anchorage, foreign materials, moisture, ridges, depressions, or other conditions which would prevent satisfactory installation of roof system.

D. Start of work constitutes acceptance of deck substrate and site conditions.

E. Sweep deck substrate clean of dust and debris immediately prior to installation of insulation.

3.03 APPLICATION OF INSULATION – GENERAL INSTRUCTIONS

A. Manufacturer's Instructions: In regard to attachment, the manufacturer's instructions or specifications shall determine the suitability for an application. Installation must meet ASCE 7 criteria and meet local governing building codes.

B. Precautions: The surface of the insulation must not be ruptured due to overdriving of fasteners.

C. Thermal insulation boards shall be laid on the substrate in parallel rows with end joints staggered and butted as close as possible. All joints shall be tight and at the roof perimeter and roof penetrations, insulation shall be cut neatly and fitted to reduce openings to a minimum. All openings one-fourth inch (1/4") or larger shall be filled with insulation.

D. Insulation shall be tapered or feathered at drains and scuppers to provide proper drainage (if applicable).

E. No more insulation shall be installed than can be covered by the completed roof system by the end of the day or the onset of inclement weather.

F. Tapered insulation and crickets, when specified, shall be placed in accordance with the drawings and/or as required to minimum of NRCA standards.

3.04 APPLICATION OF INSULATION OVER METAL DECK – MECHANICALLY FASTENED/ADHERED

A. Specified flat stock insulation shall be mechanically fastened to conform to the ASCE 7 criteria for wind uplift as dictated by wind zone applicable to location of project. Fasteners and fastening patterns shall be determined by building height, location and geographical area of the United States. It is the contractor's responsibility to consult current publications, literature, and bulletins of IBC and the manufacturer that are in effect at the time of this project. Boards shall be staggered and butted as close as possible with voids over one-fourth inch (1/4") to be filled.

B. Insulation shall be laid with edges parallel to flutes and bearing on deck surface/flats. The long dimension of base insulation layer must be fully supported by the top flange of the metal deck. The edges of insulation boards must not cantilever over the flutes of the metal deck.

C. The top surface of the mechanically fastened layer of flat stock insulation shall be coated with hot asphalt using twenty-five pounds (25#) ±20%, per one hundred (100) square feet of surface, and a second layer of specified flat stock insulation shall be applied using offset joints, so that each layer breaks joints to a minimum of six inches (6") both ways with the preceding layer, and immediately walked in place and then rolled with a 200 lb roller.

D. The top surface of the preceding layer of insulation shall be coated with hot asphalt using twenty-five pounds (25#) ±20%, per one hundred (100) square feet of surface, and specified cover board shall be applied using offset joints, so that each layer breaks joints to a minimum of six inches (6") both ways with the preceding layer, and immediately walked in place and then rolled with a 200 lb roller.

Slope	Interply& Top Pour	Backnail	Strap
0 - ½" per 12"	Type IV	No	No
½" - 2" per 12"	Type IV	Yes	Strap if possible
2" - 3" per 12"	Type IV	Yes	Yes

3.05 ADJUSTING

A. Remove insulation which has been damaged (broken, cracked, punctured, wet, etc.) and install acceptable new units before installation of roof system.

3.06 CLEANING

A. Remove debris and material wrappers from jobsite. Leave insulation clean and dry, ready to receive roofing membrane.

END OF SECTION

SECTION 07 2550
WEATHER BARRIER COMPLETE ENVELOPE SYSTEM

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 01 43 39 - Mock-Up Submittals

B. Section 06 16 63 – Exterior Gypsum Sheathing

1.02 SUMMARY

A. Section includes single source type system for fluid-applied, vapor-permeable membrane air barriers, membrane flashings, sealants, mastic and through-wall flashing. (The entire wall envelope system).

B. Contractor shall review American Concrete Institute 530.1 mandatory specification checklist for additional requirements necessary for the specific project.

C. Flashing system shall be provided and installed by a Certified Manufacturer approved waterproofing contractor.

D. Contractor shall provide a photo manifest of through-wall, window and door flashings and fluid applied barriers including all starts, stops, and transitions in plane as well as wet mil application of fluid applied products.

E. It is the intent of this specification that the new work will provide a watertight facility (restricted to the location where work is to be performed). The attached specifications describe the minimum acceptable standards of single source products, construction and finish.

F. Contractor is to provide written documentation that all envelope components air barrier, flashings, sealants, mastics and associated components included in the envelope are compatible. Contractor to provide “Compatibility Report” as part of the submittal package that confirms that all envelope related products described in this specification, to be used on the job, have been checked for compatibility with all other products (Masonry, metal panels, window systems, door systems or otherwise) that they will touch or be placed in-close-proximity to. Compatibility with the following items, but not limited to the following, shall be confirmed: air / water barrier materials, any vapor retarders if any, flashing membranes, thru-wall flashing, metal frames, insulation, and sheathing surfaces. Incompatible products shall not be provided nor combined. Products that are incompatible with the air / water barrier shall not be provided nor combined and used with the air barrier.

1.03 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to

a wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Membrane Flashings: Adhered membrane to be utilized to flash into and around wall system openings such as window, doors, pipe penetrations, structural penetrations etc.

E. Through-wall membrane Flashings: Adhered membrane(s) to provide water-tight drainable plane of the wall system to allow water to migrate to the exterior of the wall system(s).

F. Terminations: Extruded termination bar to secure membranes to the exterior wall system substrate.

G. Sealants/mastic: Manufacturers supplied sealants/mastics to provide final termination, bonding of components.

H. System: Single source manufacturer to provide all membranes, barriers, accessories to meet the design intent.

1.04 WARRANTY

A. Manufacturer to provide a minimum of a Ten-year System type warranty, including labor and materials.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review membranes, air-barrier and accessory requirements to provide a quality installation, special details, mockups, air-leakage and bond testing, air-barrier protection, water testing of openings and work scheduling that covers the envelope air barriers, membranes and associated components.
   2. Attendees to include Architect, Sub-contractor, General Contractor, Manufacturer Rep and Envelope Consultant.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for substrate preparation, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For window and door flashing membrane(s), through-wall flashing(s), air-barrier assemblies.
   1. Show locations and extent of membranes and air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, step transitions, terminations, and tie-ins with adjoining construction.
   2. Include details of interfaces with other materials that form part of air barrier such as windows, doors and wall penetrations.
   3. Include layouts and full-size details for all work covered under this section.

C. Manufacturers letter of component compatibilities for envelope system.

D. Manufacturers Inspection Report of site visits.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.

B. Product Certificates: From membranes(s) and air-barrier manufacturer, certifying compatibility of air barriers membranes and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Installation Instructions: Submit manufacturer's installations instruction for the air barrier system.

D. Certifications of approved applicator letter from the Manufacture of the envelope products.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and certified/approved by manufacturer. Named approved company by the manufacturer shall not sub the work to a non-approved contractor.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
   2. Source Limitations: Provide membrane(s) and air barrier membrane and accessory materials produced by single manufacturer.

B. Mockups: Mock up guidelines, refer to mock-up specification section and mock-up details. Build mockups to set quality standards for materials and execution.
   1. Build integrated mockups of exterior wall assembly, 150 sq. ft. minimum incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mock-ups to permit observation by Architect, Owner's Representative of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane, window intersect, building corner condition, and foundation wall intersection.
      c. If Architect, Owners Representative determines mock-ups do not comply with requirements, reconstruct mockups and apply membranes and air barrier and accessories until mockups are approved.
   2. Water testing of windows systems and envelope system shall be tested per AAMA guidelines or water wand testing. The test is pass or fail.
   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.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace membrane and liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

C. Protect products that are temperature sensitive.

D. All products are to be in manufacturers brand stamped containers.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply membranes and air barrier within the range of ambient and substrate temperatures recommended by membrane and air-barrier system manufacturer.
   1. Protect substrates from environmental conditions that affect membranes and air-barrier performance.

   2. Do not apply membranes or air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.11 WARRANTY

A. Provide manufacturer's full system 10-year warranty.

PART 2 - PRODUCTS

2.01 SUSTAINABILITY REQUIREMENTS

A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section for sustainable design requirements.

2.02 MATERIALS, GENERAL

A. Source Limitations: Obtain primary membrane(s) air-barrier materials and accessories from single source from single manufacturer, including all fluid applied barriers, flashings, sealants/mastic (related to the weather barrier), membranes, accessories.

2.03 PERFORMANCE REQUIREMENTS

A. General: Exterior envelope system shall be performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Envelope system assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at exterior perimeter conditions without deterioration and air leakage or water entry exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283 ASTM E 783 or ASTM E 2357.

2.04 WEATHER BARRIER ENVELOPE SYSTEM COMPONENTS:

A. Basis of Design Envelope System:
   1. Tremco Incorporated, an RPM company
      a. ExoAir 220.
      b. ExoAir components including ExoAir 110 and ExoAir 110AT
      c. Self-Adhered Air & Vapor Membranes: ExoAir TWF (Thru-Wall Flashing) Membrane,
      d. Sealants & Accessories: ExoAir Primer, Dymonic 100, Spectrem® 1, Tremflex® 834, or Proglaze ETA Connections

   2. Acceptable System Manufacturers:
      a) Tremco Incorporated, an RPM company; ExoAir 220.
      b) Meadows, W. R., Inc.; Air-Shield LMP.
      c) Carlisle Coatings and Waterproofing; CCW 705
      d) Grace, W. R., & Co. - Conn.; Perm-A-Barrier Wall flashing
      e) Other manufacturers as requested and approved through the substitution request process.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane. Minimum 60 Mil (1.5 mm) Wet Film Thickness Rolled: Cured Film Thickness: 30 mil (0.8 mm)
   1. Products: Subject to compliance with requirements:
      a. Elastomeric, Modified Bituminous Membrane:
         a) Fluid-Applied Vapor-Permeable Air Barrier membrane is a monolithic, elastomeric membrane designed to be rolled on exterior above-grade wall assemblies to prevent air infiltration/exfiltration while remaining permeable to the passage of water vapor
      b. ASTM International (ASTM): www.astm.org:
         a) ASTM A 240/A 240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
         b) ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
         c) ASTM C 1193 - Guide for Use of Joint Sealants
         d) ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
         e) ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
         f) ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials
         g) ASTM E 162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
         h) ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors
         i) ASTM E 1186 - Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
         j) ASTM E 2178 - Standard Test Method for Air Permeance of Building Materials

k) ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

12) Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

c. High Heat Synthetic Polymer Membrane:

1) Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

2) Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.

3) Ultimate Elongation: Minimum 200> percent; ASTM D 412, Die C.

C. Membrane Flashing

1. Through-Wall Flashing

a) Provide a membrane constructed to perform as a through-wall flashing durably integrated with the wall assembly's water resistive barrier and cavity drainage system. The installed through-wall flashing shall perform as a liquid water drainage plane to discharge incidental condensation or water penetration to the exterior through the cavity drainage system.

b) Provide a adhered, water proof membrane through-wall flashing of minimum 0.040 inch (40 mils) thickness consisting of 0.032 inch (32 mils) rubberized asphalt adhesive fully-coating 0.008 inch (8 mils) smooth surface, cross-laminated HDPE film.

2. Membrane shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Tensile Strength	Not less than 900 psi	ASTM D-412
Puncture Resistance	Not less than 80 lb.	ASTM E 154
Low Temperature Flexibility	Unaffected at minus 25 degrees F, 0.063 inch mandrel	ASTM D 146
Peel Adhesion	Not less than 5 lb per inch width on concrete prepared with contact adhesive	ASTM D 903
Lap Adhesion	Not less than 5 lb. per inch width	ASTM D 1876
Water Vapor Permeance	Not more than 0.05 Perm	ASTM E-96, Method B
Water Absorption	Not more than 0.12 percent by weight	ASTM D 570

D. Pre-Formed Transitions

1. Preformed Shapes: Flashing System's three dimensional pre-formed shapes. Preformed Shapes are manufactured of high performance black polymeric membrane by vacuum forming or injection molding. Cloaks are one-piece construction with no seams and are provided in several shapes. Provide shapes as needed to meet Project

requirements including, but not limited to detail corners, level changes, stop ends, and other similar special applications.

E. Wall Flashings: Window, Doors, Penetrations
1. Rolled, Self-Adhering Sheet Flashing Membrane: 40 mils (1.0 mm) thick membrane.
a. Performance Based Specification: Self-adhering sheet flashing membrane shall have the following characteristics:
a. Color:
1) Carrier Film: White.
2) Polymeric Membrane: Black.
3). Thickness: 40 mils (1mm).
4). Tensile Strength Film:
1) ASTM D412, modified (MD): 4,000 psi (27.6 MPa).
2) ASTM D882 (MD): 23.5 lb./in. (4.1 N/mm).
5). Elongation Film:
1) ASTM D412, modified (MD, %): 400 (Typical).
2) ASTM D882 (MD, %): 400 Min.
6). Puncture Resistance, ASTM E154: 40 lbf (178 N) Min.
7). Water Vapor Permeance (free film), ASTM E 96, Procedure B: 0.035 Perms.
8). Air Permeability, ASTM E283 / E2178: 0.004 cfm/ft.^{2} @ 75 Pa (1.57 lb /ft.^{2}).
9). Lap Peel Strength @ 39^o F (3.9^o C), ASTM D903, 180 Bend: 10 lbf/in. (1.75 N/mm).
10). Low Temperature Flexibility @ -22^o F (-30^o C), CGSB 37-GP-56M: Pass
11). Surface Conditioner:
1. Temperatures above 40^o F (4^o C): Water-Based Adhesive
2. Temperatures below 30^o F (-1^o C): Solvent-Based Adhesive.

F. Pointing Mastic: Mastic for sealing penetrations and terminations of membrane. All sealant, tapes, mesh or components as required are to be supplied by the Envelope Manufacturers single source system.

2.05 ACCESSORY MATERIALS (COMPATIBILITY OF ALL PRODUCTS SHALL BE BY THE ENVELOPE AIR BARRIER MANUFACTURER).

General: All accessory materials as supplied by the by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

A. Primer: Liquid waterborne primer for substrate as supplied by the air-barrier material manufacturer.

B. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

C. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

D. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

E. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

F. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

G. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Manufacturer's Representative present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that all gypsum products are secured in place and not movement is occurring. Remove and replace any damaged gypsum wall board products.
   3. Securement of termination bar shall be 8 inches on center.
      a. Provide continuous metal banding as detailed to mechanically fasten termination bar as indicated on spacing to prevent slumping or openings.
      b. Gypsum sheathing cut as detailed to provide a compressed fitment of the membrane to prevent slumping or openings.
   4. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
   5. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   6. Verify that no honeycomb has occurred.
   7. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide

continuous support for air barrier.

3.03 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
   1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Any fasteners that may miss the framing is to remain in the wall substrate and addressed as per the manufacturer’s requirements. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip. Check wet mil thickness minimum of four times per day of application and document.

3.04 TRANSITION STRIP INSTALLATION

A. General: Install strips, transition strips, and accessory materials according to system manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by membranes and fluid air-barrier material on same day. Re-prime areas exposed for more than 24 hours.

C. Connect and seal exterior wall membranes and air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtainwall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane flashing transition strip preformed extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
   1. Membrane flashings: Roll firmly to enhance adhesion. Buckles, wrinkles or fish mouths not acceptable.

E. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations prior to application of membrane or air-barrier material with products approved by the system manufacturer.

F. Seal strips and transition strips around masonry reinforcing or ties and penetrations with

termination mastic, mastic is to be applied to the anchors of the tie system or set masonry tie on a layer of self adhered membrane.

G. Thu wall flashing termination shall be eight inches on center. Seal top of through-wall flashings to air barrier with manufacturers mastic or three course application of mastic, membrane and mastic.

H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.05 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
   1. Apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness.

C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been tested and inspected by manufacturers representative and the Owners Representative.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.06 FIELD QUALITY CONTROL

A. Manufacturers Inspection Report: Manufacture representative to visit site minimum of every two weeks for the duration of the membrane an air barrier system and at conclusion of work and provide field reports to contractor and architect.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of membrane flashings and air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions,

and mortar droppings.

4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Strips and transition strips have been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

C. Membrane flashings and Air barriers will be considered defective if they do not pass inspections.
   1. Apply additional material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness or lapping.
   2. Remove and replace deficient membranes and air-barrier components for retesting as specified above.

3.07 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect membrane flashings and air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 sixty days or degradation occurs, remove and replace membrane flashings or air barrier or install additional, full- thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
C. Remove masking materials after installation.

END OF SECTION

SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete manufactured metal panel systems for walls and soffits, including related flashings, accessory components, and attachment of metal panel systems, including all required subgirt assemblies for walls and soffits to approved substrates.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 06 1000 - Rough Carpentry

C. Section 07 2100 - Thermal Insulation.

D. Section 07 2500 - Weather Barriers: Weather barrier under wall panels.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate allowable system pressures, dimensions, layout, joints, construction details, methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inch by width of panel in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Furnish a written warranty signed by the Panel Applicator for a two (2) year period from the date of substantial completion of the building guaranteeing materials and workmanship for the preformed metal panel system, flashings and penetrations.

C. Furnish manufacturer's standard 20-year written finish warranty stating that architectural fluorocarbon finish will be:

1. Free from fading or color change in excess of 5 NBS units as measured per ASTM D2244;
2. Will not chalk in excess of a numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D4214;
3. Will not peel, crack, chip or delaminate

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on panels manufactured by Petersen Aluminum Corporation.

B. Other Acceptable Manufacturers:
1. Berridge Manufacturing Company: www.berridge.com.
2. Centria: www.centria.com.
3. Fabral Wall and Roof Systems: www.fabral.com
4. MBCI: www.mbci.com.
5. McElroy Metal: www.mcelroymetal.com.
6. Petersen Aluminum Corporation: www.pac-clad.com.

2.02 MANUFACTURED METAL PANELS

A. Panel System: Factory fabricated prefinished metal panel system, site assembled.
1. Provide exterior panels, soffit panels, and subgirt framing assembly.
2. Design Loads: In addition to the self-weight of the panel systems, metal panel systems shall be designed to resist the maximum of the following: Wind Pressures indicated on the Structural Drawings, or the wind pressures required by the version of ASCE 7 referenced in the version of the International Building Code (IBC) for this project.
3. Anchorage: Provide anchorage into approved substrate for complete metal panel system capable of resisting all required loads and pressures (i.e. gravity and wind). (Note: For ICF wall assemblies, It shall not be permitted to rely on ICF unit web components (e.g. plastic flanges buried in the insulating formwork) for anchorage of metal panel systems for walls)
4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
7. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.
8. Provide continuity of air barrier and vapor retarder seal at building enclosure elements in accordance with materials specified in Section 07 2500.
9. Custom Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as scheduled in Section 01 6210 - Schedule of Materials and Colors.

B. Exterior Wall Panels:
1. Profile: Vertical and horizontal, as indicated; Precision Series HWP as manufactured by Petersen Aluminum Corporation.
2. Material: Precoated steel sheet, 22 gage, 0.0299 inch minimum thickness.
3. Panel Width: 16 inches.
4. Color: As scheduled in Section 01 6210 - Schedule of Materials and Colors.

C. Soffit Panels:
1. Profile: Flush Panel as manufactured by Petersen Aluminum Corporation.
2. Material: Precoated steel sheet, 22 gage, 0.0299 inch minimum thickness.
3. Panel Width: 12 inches.
4. Perforated Metal Soffit Panels: Where noted on the drawings as vented soffits panels, panel shall have perforations providing 12% net free vent area.
5. Color: As scheduled in Section 01 6210 - Schedule of Materials and Colors.

D. Subgirt Framing Assembly:
   1. Profile as indicated; to attach panel system to approved substrate in a manner that is capable of resisting all required loads and pressures (i.e. gravity and wind). (Note: For ICF wall assemblies, It shall not be permitted to rely on ICF unit web components (e.g. plastic flanges buried in the insulating formwork) for anchorage of metal panel systems for walls)"

E. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

F. Expansion Joints: Same material, thickness and finish as exterior sheets; 22 gage, 0.0299 inch thick; manufacturer's standard brake formed type, of profile to suit system.

G. Trim, Closure Pieces, Caps, Flashings, Facias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

H. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

A. Concealed Sealants: Non-curing butyl sealant or tape sealant.

B. Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.

C. Field Touch-up Paint: As recommended by panel manufacturer.

D. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.03 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Provide expansion and control joints where indicated or as recommended by the manfacturer.

F. Use concealed fasteners unless otherwise approved by Architect.

G. Where metal panels are installed on the ICF Wall System, install exterior gyp sheathing, weather barrier and furring channels over the ICF System to provide compliance with NFPA 285

H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 07 5216
MODIFIED ASPHALT BITUMINOUS ROOFING

PART 1 - GENERAL

1.01 AREAS COVERED

A. Refer to roof plans for areas to be included in the scope of work.

B. For flashing of curbs, tie ins, transitions and repairs.

1.02 DEFINITIONS

ACM	Asbestos Containing Materials
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
EPDM	Ethylene Propylene Diene Monomer
EPS	Expanded Polystyrene
EVT	Equiviscous Temperatures
FM	Factory Mutual
IBC	International Building Code
KEE	Ketone Ethylene Ester
NDL	No Dollar Limit
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety & Health Administration
SBS	Styrene-Butadiene-Styrene
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPRI	Single Ply Roofing Industry
UL	Underwriters Laboratories, Inc.

1.03 REFERENCES (INCLUDING LATEST REVISIONS)

A. Comply with governing local, state, and federal regulations, safety standards, and codes.

B. Testing Laboratory Services: Test results shall meet or exceed established standards.

C. Underwriters Laboratories, Inc. (Roofing Covering): Class A fire hazard classification.

D. American Society for Testing and Materials (ASTM)

E. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual

G. American Society of Civil Engineers – ASCE 7

1.04 INSTALLER QUALIFICATIONS

A. Roofing installer must be:
1. Currently prequalified with the Owner in accordance with Owner's prequalification requirements.
2. Currently in good standing with the manufacturer.
3. Installer must be an experienced single firm specializing in the type of roofing repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable as applicators by the Architect.
4. Contractor must have successfully completed previous projects warranted by the manufacturer.

B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

1.05 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer is one that is UL listed and has FM approvals for a membrane roofing system similar to that used for this project for a minimum of fifteen (15) years.

1.06 CONTRACT DOCUMENT QUALITY ASSURANCE

A. In the case of an inconsistency between the drawings and specifications or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation.

1.07 SUBMITTALS

A. Refer to Specification Section 01 3300 for Submittal requirements

B. Shop Drawings: Provide manufacturer's approved details of all perimeter conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.

1.08 SYSTEM DESCRIPTION – CURB FLASHING, TIE IN, TRANSITIONS AND REPAIRS.

A. Typical: Two-ply, Modified Bitumen Roofing System reinforced modified bitumen cap sheet heat applied over modified bitumen base ply mopped to cover board over rigid insulation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.

C. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

D. Deliver materials in sufficient quantity to allow continuity of work.

E. Handle and store material and equipment in such a manner as to avoid damage. Liquid products shall be delivered sealed, in original containers.

F. Handle rolled goods so as to prevent damage to edge or ends.

G. Select and operate material handling equipment so as not to damage existing construction or applied roofing.

H. Moisture-sensitive products shall be maintained in dry storage areas and properly covered. Provide continuous protection of materials against wetting and moisture absorption. Store roofing and flashing materials on clean raised platforms with weather protective covering when stored outdoors.

I. Store rolled goods on end.

J. Protect materials against damage by construction traffic.

K. The proper storage of materials is the sole responsibility of the contractor and any wet or damaged roofing materials shall be discarded, removed from the project site, and replaced prior to application.

L. Comply with fire and safety regulations, especially with materials which are extremely flammable and/or toxic. Use safety precautions indicated on labels.

M. Products liable, such as emulsions, to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

N. 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.

1.10 SITE CONDITIONS

A. Job Condition Requirements:
   1. Coordinate the work of the contractor with the work to be performed by other trades, to ensure proper sequencing of the entire work. The contractor is to schedule his work so that adequate time is allowed for other trades to perform their work.
   2. Apply roofing in dry weather.
   3. Do not apply roofing when ambient temperature is below 45° F.
   4. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with specifications.
   5. Schedule the work so the building will be left watertight at the end of each day. Do not remove more roofing materials than can be reinstalled in any working day.

6. Load placed on the roof at any point shall not exceed the safe load for which the roof is designed.
7. All surfaces to receive new roofing shall be smooth, dry, and free from dirt, debris, and foreign material before any of this work is installed. Competent operators shall be in attendance at all times equipment is in use. Materials shall be stored neatly in areas designated by the Architect.
8. The contractor is to be aware of the potential for roof leaks on the existing roof as a result of ruptured blisters and/or roof mat damage caused by the vacuum process, foot traffic, or material and equipment storage. The contractor is to take all necessary precautions to prevent damage to the existing roof. All damage to the existing roof that could result in roof leaks is to be repaired on a daily basis by the roofing contractor.
9. The contractor shall follow local, state, and federal regulations, safety standards, and codes for the removal, handling, and disposal of asbestos containing materials, if present. When a conflict exists, follow the stricter document.
10. Due caution should be exercised so as not to alter the structural integrity of the deck. When cutting through any deck, care should be taken so as not to damage the deck or any part of the deck, such as post tension cables, etc.
11. All kettles shall have a fume recovery system, automatic thermostat control, and visible temperature gauge all in working order.
12. The contractor is to verify the location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. The contractor is to perform all work in such a manner as to avoid contact with the above mentioned items.
13. Surface and air temperatures should be a minimum 40° F during applications of cleaner and waterproof coating and remain above 40° F for a minimum of four (4) hours following applications. Verify compatibility of cleaner with coatings, paints, primers and joint sealers specified. Advise Project Manager/Architect of any problems in this regard prior to commencing cleaning operations.
14. Temporary Sanitary Facilities:
    a. The contractor shall furnish and maintain temporary sanitary facilities for employees use during this project, including temporary toilets, wash facilities, and drinking water fixtures.
    b. Toilet units shall be self-contained, single-occupant, of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
    c. Facilities shall be installed where they will best service the project's needs, with Owner's/Owner's Representative's approval.
    d. Contractor shall provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
    e. All portable facilities shall comply with local laws, codes, and regulations.
    f. Contractor shall be responsible to see that the units are removed in a timely manner after the completion of the project.

B. Protection of Work and Property:
1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. Contractor shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations pertaining to asbestos as required shall be fulfilled by the contractor as part of his proposal.

2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows: a) removal, protection, preservation, or replacement and replanting of plant materials; b) protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.
3. Finished roof areas shall be protected from damage by the contractor during construction.
4. Twenty-four Hour Call: The contractor shall have personnel on call 24 hours per day, seven (7) days per week for emergencies during the course of a job. The Owner/Architect is to have the 24 hour numbers for the contact. Contractor must be able to respond to any emergency call and have personnel on-site within two (2) hours after contact. Numbers available to the Owner/Architect are to be mobile, home and office numbers for:
   a) Job Foreman
   b) Job Superintendent
   c) Owner or Company Officer

C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds must be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

E. Use of Premises:
1. The contractor is advised that the Owner will occupy the building at all times, and the contractor must provide all safeguards required to protect personnel and to keep noise levels as low as reasonably possible for each operation.
2. The contractor shall:
   a) Coordinate work in such a manner as to not interfere with the normal operation of the building.
   b) Assume full responsibility for protection and safekeeping of products stored on premises.
   c) Agree to hold the Owner harmless in any and all liability of every nature and description which may be suffered through bodily injuries, including death of any persons by reason of negligence of the contractor, agents, employees, or subcontractors.

F. Cleaning and Disposal of Materials:
1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.
2. 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. A suitable scrap chute or hoist must be used to lower any debris. At completion, all work areas shall be left broom clean and all contractor's equipment and materials removed from the site.
3. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.
4. Debris shall be deposited at an approved disposal site.

1.11 SEQUENCING AND SCHEDULING

A. Coordinate roofing schedule with work of other trades.

B. Plan lay up of roofing membrane with respect to deck slope. Avoid situations where excessive drainage could pass into completed roofing.

C. Maintain communication with roofing manufacturer's representative to inform of progress and to schedule periodic inspections.

D. All penetrations shall be made in roof prior to beginning with roof installation.

1.12 PERFORMANCE REQUIREMENTS

A. Roofing System: Shall prevent water migration into roof assembly or building interior through the roof membrane and/or membrane base flashing.

1.13 QUALITY ASSURANCE

A. Work of this Section to conform to these specifications, and to the roofing material manufacturer's application instructions. In the event of conflicts between the two, the more stringent requirement shall be observed.

B. Maintain one copy of each document on site.

C. Factory Technical Representative: Roofing Contractor is to arrange and schedule the manufacturer’s technical representative to be on site the first day of the installation of manufacturer’s roofing system. The manufacturer's technical representative shall inspect the work of the contractor at least one time each week during the installation of the roofing system. The manufacturer's technical representative shall perform with the owner's representative and the roofing contractor a final inspection of the roofing system. At the completion of the final inspection, provide to the roofing contractor a list of punch list items (if any) to be correct before technical acceptance of the roofing project and prior to issuance of manufacturer's Twenty (20) Year Full System Warranty. Field reports shall be provided after each inspection within five (5) days of site visit.

D. Pullout Tests: Conduct pullout test on deck using appropriate fastener prior to roof system installation. Submit pullout results for manufacturer's review to determine specific fastening pattern for this project, minimum uplift requirements shall conform to current ASCE 7 criteria.

1.14 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of the products specified, with five (5) years documented experience in the uninterrupted, and unmodified manufacture of the roofing system and component elements of the roofing system specified herein.

B. Applicator: Company specializing in the work of this Section, having a minimum of five (5) years documented experience applying modified bitumen roofing systems, and approved by the Manufacturer for not less than three (3) years to install the specified roof system so as to achieve a twenty (20) year no dollar limit warranty.

1.15 REGULATORY REQUIREMENTS

A. Conform to all applicable local codes for roof assembly fire hazard requirements.

B. Provide certification of inspection confirming approval of design and installation by authority having jurisdiction.

C. Fire Hazard Classifications: UL Class A.

1.16 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference two weeks prior to commencing the Work.

B. Require attendance of parties directly affecting the Work of this Section.

C. Review condition of roof deck and installation, installation procedures and coordination with related work.

1.17 ENVIRONMENT REQUIREMENTS

A. Do not apply roofing during inclement weather.

B. Do not apply roofing membrane to damp or frozen deck or substrate.

1.18 WARRANTY

A. Roofing - Manufacturer: Project shall be installed in such a manner that the roofing material manufacturer will furnish a written five (5) year labor and materials warranty from the date of substantial completion of the completed project.

B. Roofing - Contractor: The 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 two (2) year warranty period, after the Owner accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the contractor and his subcontractors, if any, to make good the requirements of the warranty.

C. Warranty repairs shall be performed by a certified installer. The repairs shall be performed in accordance with the manufacturer's written instructions and recommended procedures so as to not void the warranty (if applicable). Repair of the system, including materials and labor, shall be done at no cost to the Owner.

D. Provide five (5) year manufacturers labor and materials warranty on the above-deck roofing system. Warranty to cover costs of material and labor to replace roofing material which fails to resist the penetration of water due to failure of either material or workmanship, with no penal sum.

E. Manufacturer's warranty shall cover above deck roofing components against wind uplift resulting from wind pressures based on the requirements of ASCE 7.

PART 2PRODUCTS

2.01 GENERAL

A. 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 work starting.

B. All materials used on the project shall be asbestos free

C. All materials shall be furnished, specified, or approved in writing by the manufacturer holding the existing warranty. OR All materials shall be compatible with the existing modified roofing system and in accordance to NRCA recommendations and accepted roofing industry standards.

2.02 MANUFACTURERS – SHEET AND BITUMINOUS MATERIALS

A. Soprema
B. Johns Manville
C. Or prior approved equal by Owner / Project Manager

2.03 FINISH MEMBRANE:

1. Cap Ply :
   a. Membrane Top Ply: White granulated Surface Cap Sheet:
      1) Description: Roofing membrane shall have a fiberglass mat reinforcement and thermofusible elastomeric asphalt. Top surface to have White granulated surface. Application is for heart weld
   b. Physical Properties:
      1) Approximate Weight: 104 lbs/sq
      2) Approximate thickness: 157 mils
      3) Total System thickness: 261 mils

2.04 BASE PLY MEMBRANE:

1. Fiberglass reinforced modified bitumen sheet.
   a. Description: Base ply membrane shall have a fiberglass reinforcement and thermofusible elastomeric asphalt.

   b. Physical Properties:
      1) Approximate roll weight: 90 pounds
      2) Approximate thickness: 91 mils

B. Base Flashing Membranes:
   1. Base Ply Membrane– Fiberglass reinforced modified bitumen sheet.
      a. Description: Base ply membrane shall have a fiberglass reinforcement and thermofusible elastomeric asphalt.
      b. Physical Properties:
         1) Approximate roll weight: 90 pounds
         2) Approximate thickness: 91 mils

2. Finish Membrane: Polyester reinforced modified bitumen flashing sheet.
   a. Description: Flashing membrane shall have a non-woven polyester reinforcement and thermofusible elastomeric asphalt. Both sides shall have a high-brush sanded surface. Top surface to have White High-Reflective surface. This application is to be applied by hot mopping only.
   b. Physical Properties:
      1) Approximate roll weight: 106 lbs.

2.05 BASE SHEET FOR USE OVER LIGHTWEIGHT FILL ROOF DECK

A. Shall be Underwriters Laboratory approved.

B. Shall be heavy duty, asphalt-coated fiber glass venting base sheet, with mineral surfacing on one side,

2.06 ASPHALT ROOF PRIMER

A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces, as manufactured by Gardner-Gibson, Inc. / GAF, or approved equal.

ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.07 ASPHALT PLASTIC ROOF CEMENT

A. Trowel-applied mastic used on flanges of gravel stops, stacks, vents, and similar applications, as manufactured by Gardner-Gibson, Inc. / Johns-Manville, or approved equal.

ASTM	D 4586
Flash Point	105° F
Weight per gallon (approximate)	11 lbs.
Viscosity @ 80° F (ASTM D 217)	270-330
% Non-Volatile (Fed. Test Method 141)	70% Min.
% Specially Processed Bitumen	30% Min.
% Total Solids, by Volume	75% Min.
Dry film thickness of 1 gal./15 sq. ft.	85 Mils
Drying time	2 to 3 days
Service Temperature, Extended Exposure	-20° to +150° F
Resistance to Oils & Solvents	Poor
Resistance to Sunlight	Good
Resistance to Chemicals	Good
Effects of Weathering	Slight chalking
Water Resistance	
Under Good Drainage Conditions	Excellent
Under Continuous Submersion	Fair

2.08 INSULATION

A. All insulation shall be in compliance with Section 07 2216 Roof Board Insulation.

B. 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, Underwriters Laboratory approved

2.09 SUBSTRATE BOARDS

A. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

2.10 CANT STRIP

A. Structural: Shall be wood where used for structural purposes meeting NRCA, FM Global and Underwriters Laboratory guidelines.

B. Non-structural: Shall be wood fiber where used for non-structural purposes, conforming to ASTM C208 and C209.

2.11 ROUGH LUMBER

A. All wood nailers, structural cants, curbs, and other miscellaneous rough carpentry, shall be lumber as recommended by NRCA, and Underwriters Laboratory guidelines.

B. Vertical Wall Shimming Material: Shall be exterior grade plywood unless otherwise accepted by Project Manager/Architect. Thickness shall be as required for attachment or to make material flashing flush or level with offsets and/or transitions, minimum three-fourths inch (3/4"). Proper selection of material is required to achieve UL guidelines.

2.12 FASTENERS

A. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

B. Fasteners and fastening plates or bars shall be as recommended by the fastener manufacturer for the specific application.

2.13 FIBERGLASS COATED MEMBRANE

A. A non-rotting, non-absorbent woven fiberglass membrane having a vinyl coating designed for membrane reinforcement for all roof repairs. Compatible with either tar or asphalt bitumens, having ten (10) open-weave squares per inch.

2.14 LEAD JACKS

A. Shall be four pound (4#) lead, and of dimensions required to completely cover existing plumbing stack.

2.15 LIQUID FLASHING SYSTEM

A. Liquid flashing system to be manufacturers recommended system comprising a liquid compound and sheet scrim fabric or equivalent.

2.16 ROOF WALKWAY PADS

A. Walkway Pads: Manufacturer's standard walkway pads consisting of modified asphalt, reinforcements and fillers with a ceramic granule surface on both sides. Thickness shall be 1/4" min.

2.17 DELIVERY AND STORAGE

A. All materials shall be delivered with appropriate carton and can labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

2.18 PRECAUTIONS

A. Some of the indicated materials are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

2.19 OVERNIGHT SEAL

A. Hot applied asphalt bitumen shall be provided for the purpose of night sealing the roof system.

B. Apply a six inch (6") wide mopping of asphalt along the exposed edges of the white fleece backed base flashings as required to prevent wicking into the membrane.

2.20 MISCELLANEOUS MATERIALS

A. Other materials shall be as specified, or of the best grade for the proposed use, as recommended by the manufacturer of said product.

2.21 EXPANSION JOINTS

A. Provide field fabricated wood expansion joints where shown on the drawings in size as indicated and acceptable to authorities having jurisdiction.

B. Expansion joint nailers shall extend upward a minimum of eight inches (8") above finish roof height.

C. Existing expansion joints shall be replaced with curbed expansion joints which extend a minimum of eight inches (8") above the finished roof surface. New expansion joint cover shall be fabricated of

sheet metal in accordance with NRCA and/or SMACNA details and flashed in accordance with roofing material manufacturer's recommended procedures.

D. Expansion joints at walls and field of the roof shall be curbed as outlined in accordance with NRCA and SMACNA guidelines. The curbs will be flashed as outlined above in Curb Flashings.

E. Provide structural expansion joint in the field of the roof where the roof span exceeds 200'-0" in any direction.

PART 3EXECUTION

3.01 REFERENCE

A. In the instance of a conflict between these specifications and those of the manufacturer and/or current NRCA, Underwriters Laboratory and IBC guidelines, the more stringent specifications (better quality or greater quantity of work) shall take precedence.

B. The manufacturer's Technical Specifications and current NRCA, Underwriters Laboratory and IBC guidelines shall be considered a part of this specification and shall be referred to for general application procedures and recommendations.

C. Application of materials shall be in strict accordance with the manufacturer's recommendations and current NRCA, Underwriters Laboratory and IBC guidelines, except where more stringent requirements (better quality or greater quantity of work) are shown or specified.

D. General Installation:
1. Comply with governing local, state, and federal regulations, safety standards, and codes. When conflict exists, the more restrictive document shall govern.
2. Protect adjacent areas with tarpaulin or other durable materials.
3. Contractor shall prevent overspray and be responsible for parking lot areas and/or adjoining areas not part of this contract.
4. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
5. Prepare surfaces according to manufacturer's or applicator'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. Any prefinished galvanized sheet steel that is to receive bitumen, or come in contact with bitumen or adhesive, shall be scored, scuffed or abraded before receiving primer application.
6. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
7. All surfaces/substrates shall be clean and dry prior to application of materials.
8. Prior to application of felts and or membrane, all foreign matter, gravel, etc., shall be removed from the insulation and/or substrate. Gravel or debris between the insulation/substrate and plies is not acceptable.
9. Prior to application of flashing membranes, substrate shall be clean and free of any previously installed roofing materials. Contractor shall ensure that all components of substrate be structurally sound before application of flashing materials.
10. The underlayment plies and field membrane are to be laid in the direction of maximum roof slope, working from bottom of slope toward ridge.
11. Wrinkles, buckles, kinks, and fish mouths are not acceptable when laying membranes.
12. Dry voids of membrane on membrane are not acceptable.
13. All surfaces that are to receive the self-adhered membranes shall be primed with a fast drying asphaltic primer.

14. Application of roofing shall immediately follow the application of any insulation as a continuous operation. Under no circumstance is insulation to be left exposed at the end of the day. Insulation left exposed overnight will be removed and replaced at no cost to the Owner.
15. Masonry and metal surfaces to receive roofing shall be primed with a uniform coating of approved asphalt primer.
16. Unless otherwise noted, all layers of roofing shall be installed perpendicular to the slope of the deck; completely free of wrinkles, creases or fishmouths. Membrane application by the "mop and flop" technique will not be permitted.
17. Asphalt kettles or tankers employed under this Contract shall be equipped with functioning, accurately calibrated, readable thermometers.
18. Asphalt shall be applied in uniform mopping free of voids or holidays, at a rate recommended by the roofing manufacturer and not more than 25° F above the asphalt's listed Equiviscous temperature (EVT).
19. Consider roof system manufacturer's technical specifications part of this specification and use as reference for specific application procedures and recommendations

3.02 EXAMINATION

A. Examine roof deck and related surfaces and verify that there are not conditions such as inadequate anchorage, foreign materials, moisture, ridges, or other conditions which would prevent satisfactory installation of roofing system.

B. Correct conditions requiring correction or completion prior to installation of roofing system. Notify Owner's representative (Owner's representative, Contractor Officer) of unacceptable conditions.

C. Do not proceed until defects are corrected.

D. Verify location of interior ducts, electrical lines, piping, conduit, an similar obstructions. Perform work in manner to avoid contact with above mentioned items.

E. Verify debris has been removed.

F. Start of work under this Part Three constitutes acceptance of deck substrate and site conditions by roofing contractor

3.03 SUBSTRATE PREPARATION

A. Peel Down to Existing Insulation: Remove existing roof membrane down to top layer of sound insulation. Substrate shall be smooth and free of debris, sharp edges, and other surface irregularities prior to work starting. Existing surface shall be leveled prior to installation of approved insulation board. Remove and replace all wet roof assembly materials as required to minimum of NRCA standards.

B. Protect all building surfaces against damage from roofing work.

C. Prevent debris and bitumen from entering the building, any drains, downspouts, plenum spaces and/or roof openings.

D. Clean surfaces of roof deck and maintain free of dirt, debris and any deleterious material during roofing operations.

E. Metal Decks:
1. All loose rust, bitumen, or other foreign material shall be removed from the deck before applying **metal primer** at the minimal rate of one and one-half (1-1/2) gallons per one hundred (100) square feet of area.
2. Deteriorated metal decking shall be repaired or replaced as required and as recommended by the deck manufacturer on a unit cost basis as approved by /Architect.
3. The metal deck shall be of like kind, quality, gauge and configuration. The deck span shall not exceed that recommended by FM Global Bulletin 1-28.
4. If metal deck must be replaced:
   a) Erect metal decking as recommended by the SDI. Properly align and level on structural supports.
   b) Allow minimum three inch (3") bearing when supported by structural steel and minimum six inch (6") bearing when supported by masonry.
   c) Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent blowholes.
   d) Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting members.
   e) Side lap fasteners shall be No. 12, self-drilling, self-tapping screws.
   f) Install closure strips and angle flashings as required to close openings between deck and walls, columns and openings.
   g) Immediately after installation, touchup welds, burned areas and damaged spots with prime paint.
5. Expansion/control joints shall be installed so that no one area exceeds two hundred feet by two hundred feet (200' x 200').

F. Above-Deck Fills:
1. Roofing substrate must be acceptable to the manufacturer prior to application of roof materials.
2. Nailable fills shall receive a specified base sheet properly fastened with suitable fasteners.
3. Fill shall be patched with quick setting cement as required to provide a smooth substrate for installation.

J.

3.04 CATEGORY II (NON-FRIABLE) ASBESTOS CONTAINING MATERIALS (ACM) REMOVAL

A. Owner and Contractor agree to exonerate, indemnify, defend, and hold harmless the roofing material manufacturer from and against all claims, demands, lawsuits, damages, expenses and losses incurred by Contractor's removal of asbestos-containing materials from Owner's building and work site. Contractor must conduct its operations according to applicable requirements including but not limited to those established by:
1. Occupation Safety and Health Administration (OSHA).
2. Environmental Protection Agency (EPA).
3. Department of Transportation (DOT).
4. State or Local Air Pollution Control Authorities/Agencies.
5. State or Local Solid Waste or Hazardous Waste Authorities/Agencies.
6. State or Local Health Department(s).
7. State or Local Building Code Authorities.
8. Other federal, state or local agencies or authorities.

B. Contractor or Owner shall perform appropriate inspections, surveys and file timely notifications to proper authorities prior to starting roof renovation or demolition activities. Inspectors, project

planners, project managers, contractors and workers involved in the roof project shall have appropriate training, licenses and registrations. Contractor and Owner shall be responsible for determining and implementing regulatory compliance activities, including but not limited to work practices, engineering controls, personal protection, air monitoring, testing, hazard communication, material handling, record retention, and arranging for waste disposal/handling.

C. Contractor must file a Uniform Hazardous Waste Manifest from proper landfill site for each load of asbestos containing material removed. Copies must be sent to Architect. Transportation of waste shall be in accordance with applicable Department of Transportation (DOT) requirements.

3.05 ROUGH CARPENTRY

A. All rough carpentry shall be in compliance with Section 06 10 53 Miscellaneous Carpentry.

B. Nailers shall be installed according to NRCA, Underwriters Laboratory, and IBC guidelines.

C. Wooden nailers shall be installed at Metal edges, drip edges, expansion joints, and on outside perimeter of building.

D. Metal Edge and drip edge nailers shall be the same height as the new insulation being installed where required.

E. Nailers shall be raised if necessary by anchoring an additional nailer of appropriate height to the existing nailer if the existing nailer is not to be replaced.

F. Expansion joint nailers shall extend upward a minimum of eight inches (8") above finish roof height.

G. Where parapet wall exists, specified vertical wall shimming material shall be installed beginning at roof height up to a minimum of twelve inches (12”) above finished roof surface, or as detailed, to provide substrate for horizontal termination of roof to wall flashing system.

H. Any lumber or shimming required for attachment, or to make material flashing flush or level with offsets and/or transitions, shall be incorporated in these specifications.

3.06 CANTS

A. Provide full 45 degree cant strips (no partials) at all intersections of vertical and horizontal surfaces, such as walls, parapet walls, curbs, expansion joints, etc., and as recommended by membrane manufacturer.

B. Cants shall provide a four (4) inch rise above the roof’s surface.

C. Toe of cant shall be level with the surface to receive new roof membrane and in all cases anchored according to NRCA, Underwriters Laboratory, and IBC guidelines.

D. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.

E. If a wood cant is used where insulation exists, cant shall be toe nailed into treated wood nailer under cant the same height as insulation.

3.07 MECHANICALLY FASTENED BASE SHEET OVER SUBSTRATE

A. Substrate shall be covered with a specified base sheet mechanically fastened as follows:
   1. Securement shall conform to the ASCE 7 criteria for wind uplift as dictated by wind zone applicable to location of project. Fasteners and fastening patterns shall be determined by building height, location and geographical area of the United States. It is the contractor's responsibility to consult current codes, publications, literature, and bulletins of IBC and the fastener manufacturer that are in effect at the time of this project.

3.08 INSULATION

A. All insulation shall be in compliance with Section 07 2216 Roof Board Insulation.

B. 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, Underwriters Laboratory approved

3.09 SUBSTRATE BOARDS

A. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

3.10 APPLICATION OF UNDERLAYMENT PLY SHEETS

A. Cover board shall be covered with one (1) layer of specified fiberglass ply sheet adhered.

B. All layers shall be solid mopped in a uniform and continuous manner at the nominal rate of thirty pounds (30#) ± 20% per one hundred (100) square feet using steep asphalt Type IV as required by slope, properly heated and applied within the Equiviscous Temperature (EVT) range.

C. Apply adhesive no more than ten (10) feet ahead of each roll being embedded.

D. Broom each ply from the unmopped side before adhesive cools. Ensure complete and continuous seal and contact between bitumen and ply sheets without wrinkles, including ends, edges, laps, fish mouths, or blisters. Broom width shall be thirty-four inches (34") minimum. Avoid walking on plies until adhesive has set.

E. Specified layers shall be applied in accordance with the manufacturer's recommendations and in accordance with general practices as set forth by the NRCA Roofing Manual.

F. Use starter sheets at all edges as required. Two-ply underlayment requires a nineteen inch (19") starter sheet.

G. If slope dictates, underlayment plies shall be installed using the strapped method going with the slope as required by membrane manufacturer

3.11 APPLICATION BASE MEMBRANE

A. Apply base membrane sheet over prepared substrate in mopping of hot asphalt, providing four inch (4") side laps and six inch (6") end laps. Stagger end laps of adjacent sheets not less than thirty-six inches (36").

B. Apply sufficient pressure to the top side of the sheet to ensure that the base ply is adhered.

3.12 APPLICATION FINISH MEMBRANE

A. Beginning at low point of roof, apply approved cap sheet in mopping of hot asphalt. Provide four-inch (4") side laps and six inch (6") end laps. Stagger end laps thirty-six inches (36") from adjacent rows.

B. All layers of roofing shall be installed free of wrinkles, creases and fishmouths.

C. Prohibit foot and cart traffic from newly applied felts. Do not "walk-in" plies.

D. The asphalt must be mopped so as to extend beyond both edges of the sheet. The amount of asphalt should be just sufficient for excess asphalt to squeeze out along the edges.

E. If slope dictates, membrane shall be installed using the strapped method going with the slope as required by membrane manufacturer.

F. In addition to the standard application procedures as outlined, the contractor must be familiarized and adhere to the manufacturer's requirements for proper installation procedures for the cool roof white cap sheet.

G. Care must be taken to ensure good alignment of the first roll. A 45° cut shall be made on the selvage edge of underlying membrane prior to application to ensure a good seal between the membranes.

3.13 FLASHING APPLICATION

A. Flash all penetrations, metal edge systems, walls, curbs, expansion joints, drains as shown on details and approved shop drawings with white Elvaloy® flashing membrane.
   1. Field fabricate flashings for vent pipes, vent stacks, or other multi-angled roof projections/penetrations.
   2. Mechanically fasten flashing at terminations according to approved details.
   3. Fastening membrane flashing through metal counterflashing without the use of a termination bar is not acceptable.

B. Any lumber or shimming required for attachment or to make material flashing flush or level with offsets and/or transitions shall be incorporated in the flashing specifications.

C. Flashing shall be placed at all vertical junctures with the roof, and at all penetrations. It will consist of the approved base flashing sheet applied over one or more base ply sheets.

D. Base membrane sheet will be placed in a mopping of hot asphalt providing three inch (3") side laps. Secure top edge with approved fasteners at six inches (6") on center. Sheet to extend four inches (4") beyond the toe of the cant onto the horizontal surface of the membrane; and extend not less than three inches (3") above the top of the cant onto the vertical wall/curb surface. The top leading edge shall be secured with a continuous termination bar, fastened at 8” o.c., the termination bar shall be sealed with three course and mastic.

E. Flashing plies shall be cut from the end of the roll and applied vertically always working to a selvage edge.

F. The exposed flashing membrane will be mopped into place providing three inches (3") side laps. Top edge to be secured with approved fasteners at six inches (6") on center. Side laps are not to coincide with side laps of reinforcing ply sheet.

G. Prime surface of membrane sheet to receive flashing.

H. Extend flashing sheet four inches (4") beyond toe of cant onto horizontal field of the roof, and extend onto vertical face of wall/curb not less than eight inches (8") above finished roof surface. Secure top edge termination bar and three course mastic application. Termination bar to be fastened with approved fasteners at six inches (6") on center.
1. At concrete or masonry surfaces, secure top edge of flashing utilizing a continuous metal termination bar.
2. Thoroughly seal all voids in the corners and seams.
3. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.

3.14 CANTS

A. Provide full 45 degree cant strips (no partials) at all intersections of vertical and horizontal surfaces, such as walls, parapet walls, curbs, expansion joints, etc., and as recommended by membrane manufacturer.

B. Cants shall provide a four (4) inch rise above the roof's surface. (Vertical, not diagonal)

C. Toe of cant shall be level with the surface to receive new roof membrane and in all cases anchored according to NRCA, Underwriters Laboratory, and IBC guidelines.

D. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.

E. If a wood cant is used where insulation exists, cant shall be toe nailed into treated wood nailer under cant the same height as insulation.

3.15 PROJECTION FLASHINGS

A. Plumbing Vents: Soil vent stack pipes shall receive new lead flashings installed in strict accordance with practices set forth in the NRCA Roofing Manual. The lead shall be carried up and over the top of the stack, and crimped down into the pipe to form a watertight seal. Projections that cannot be sealed thus should be boxed in and flashed as recommended by the roof membrane manufacturer.

B. Square Projections: Cut a slit in the membrane to correspond with the position of the projection, and lay the membrane in hot asphalt. Apply another layer of membrane in exactly the same fashion, but from the opposite direction. For metal flange-type projections, after doing above, strip in with six inch (6") strips of membrane.

C. Round Projections: Cut membrane square and eighteen inches (18") from perimeter of projection. Slit square membrane with an "X" of proper size to ensure a close fit and positive seal. Place over projection, and adhere to clean membrane already on the roof. Cut a six inch (6") piece of membrane to apply as a collar, and secure with an all stainless steel clamp.

3.16 CURB FLASHINGS

A. The flashing substrate shall be free of any dirt and loose material.

B. The underlayment ply or plies and the coal-tar elastomeric membrane (CTEM) shall be brought to two inches (2") past the top of the cant strip and adhered.

C. Starting on the roof at least six inches (6") from the roofside edge of the cant strip, adhere one (1) ply of smooth sanded modified base membrane extending over the cant and up the vertical a minimum of eight inches (8"). Each lap of the membrane shall be a minimum of three inches (3").

D. Over the smooth sanded modified base membrane starting on the roof at least eight inches (8") from the roofside edge of the cant strip, adhere the finished membrane extending over the cant and up the vertical a minimum of eight inches (8"). Each lap of the finished membrane shall be a minimum of three inches (3"), and shall not coincide with the laps of the underlayment sheet.

E. Fasten the top edge of the flashings on six inch (6") centers using approved termination bar and fasteners. Cover termination bar with 3 course and mastic to seal leading edge of the finished membrane watertight.

F. An NRCA-approved metal counterflashing shall extend down over the flashing a minimum of four inches (4").

3.17 EXPANSION JOINTS

A. Expansion material shall be formed and centered over the roof to roof structural EJ locations as shown on the drawings.

B. Coordinate the location of the expansion joint framing with Structural, Architectural and Roof drawings.

C. Framing of the expansion shall be in accordance with the details and as field conditions dictate.

D. Expansion material shall be formed and located adjacent to roof to rise wall structural EJ locations as shown on the drawings.

E. Wood Cants shall provide a four inch (4") rise above the roof's surface and extend a minimum of four inches (4") horizontally.

F. Vertical wood framing shall be attached over horizontal wood blocking as shown and detailed.

G. Taper the top of the expansion join as required at tapered roof areas to maintain a minimum height of 8" above finished roof surface.

H. Provide a field-built wood, structural expansion joint in the field of the roof where the roof span exceeds 200'-0" in any direction.

3.18 MEMBRANE PROTECTION

A. Walk Way Pads: Install manufacturer's walk way pads continuously on each side of each air-handling/mechanical unit on the roof in accordance with the manufacturer's recommended procedures.

B. Where equipment pads, wood sleepers, or walkway slabs are to be installed over the roofing membrane, an additional layer of the roofing membrane shall be installed between the roofing membrane and the pad, sleeper, or slab. Due caution shall be exercised to prevent roofing membrane damage during placement. Where required, membrane shall be welded to field membrane to prevent slippage.

3.19 TERMINATION OF NEW ROOF TO EXISTING

A. The final juncture of the new roof shall consist of an NRCA recommended area divider suitably flashed and sealed for a permanent watertight installation. A water cutoff shall be incorporated into the termination to prevent water entering the existing roof from migrating into the new roof system.

3.20 ELASTOMERIC SEAM COATING

A. Cover bleed out blocking with elastomeric seam coating approved by manufacturer. Coating shall be applied using a medium nap roller.

B. Temperatures at time of application must be 50 deg. F and rising during time of application. Apply per manufacturer's recommendations.

3.21 OVERNIGHT SEAL

A. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

B. Installation shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.

3.22 FIELD QUALITY CONTROL

A. Owner reserves the right to have finished Work inspected using infrared thermography or other appropriate, non-destructive means to establish satisfactory conditions of completed Work.

B. Correct identified defects or irregularities. Cut out and repair membrane defects before end of each day.

3.23 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services as required to qualify for specified warranty.

B. Roofing materials manufacturer's representative shall visit the site and observe the progress of the Work at a rate of not less than one time per week.

1. Site visits shall be followed up by a written report of findings which is to be transmitted to the Owner's Representative within five (5) days of the site visit.

3.24 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are marred, or soiled by Work of this Section, consult manufacturer of soiled surface for cleaning advice and conform to their written instructions.

C. Repair or replace defaced or disfigured finishes caused by Work of this Section.

D. Roof surface shall be completely cleaned prior to final building move-in. All discharge water to be dealt with in accordance with local EPA requirements.

3.25 PROTECTION OF FINISHED WORK

A. Protect finished Work under provision of application Section.

B. Where traffic must continue over finished roof installation, protect surfaces with minimum one-half inch (1/2") wood fiberboard insulation, under five-eighth inch (5/8") thick plywood protective walkways ballasted in place with sandbags or the like.

C. At all parapet and metal coping cap conditions, provide additional layer of self-adhered underlayment for temporary protection over all parapet and coping caps conditions once roofing has been completed and prior to installation of wood nailers and metal coping cap. Self-adhered underlayment is to cover cavity conditions from roof side of parapet framing to outside of exterior finish to protect cavity from moisture prior to completing parapet cap framing.

END OF SECTION

SECTION 07 5419
ADHERED MULTI-PLY ROOF SYSTEM

PART 1 - GENERAL

1.01 AREAS COVERED

A. Refer to roof plans for areas to be included in the scope of work.

1.02 DEFINITIONS

ACM	Asbestos Containing Materials
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
EPS	Expanded Polystyrene
EVT	Equiviscous Temperatures
FM	Factory Mutual
IBC	International Building Code
KEE	Ketone Ethylene Ester
NDL	No Dollar Limit
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety & Health Administration
SBS	Styrene-Butadiene-Styrene
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPRI	Single Ply Roofing Industry
UL	Underwriters Laboratories, Inc.

1.03 REFERENCES (INCLUDING LATEST REVISIONS)

A. Comply with governing local, state, and federal regulations, safety standards, and codes.

B. Testing Laboratory Services: Test results shall meet or exceed established standards.

C. Underwriters Laboratories, Inc. (Roofing Covering): Class A fire hazard classification.

D. American Society for Testing and Materials (ASTM)

E. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual

G. American Society of Civil Engineers – ASCE 7

1.04 INSTALLER QUALIFICATIONS

A. Roofing installer must be:
   1. Currently certified or an approved applicator that is in good standing with the manufacturer.
   2. Installer must be an experienced single firm specializing in the type of roofing, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable as applicators by the Architect.
   3. Contractor must have successfully completed previous projects warranted by the manufacturer.

B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

1.05 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer that has been UL Listed and has FM Approvals for membrane roofing system similar to that used in this project for a minimum of fifteen (15) years.

1.06 CONTRACT DOCUMENT QUALITY ASSURANCE

A. In the case of an inconsistency between the drawings and specifications or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation.

1.07 SUBMITTALS

A. Shop Drawings: Provide manufacturer's approved details of all perimeter conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.

B. Refer to Specification Section 01 3300 for Submittal requirements

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.

C. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

D. Deliver materials in sufficient quantity to allow continuity of work.

E. Handle and store material and equipment in such a manner as to avoid damage. Liquid products shall be delivered sealed, in original containers.

F. Handle rolled goods so as to prevent damage to edge or ends.

G. Select and operate material handling equipment so as not to damage existing construction or applied roofing.

H. Moisture-sensitive products shall be maintained in dry storage areas and properly covered. Provide continuous protection of materials against wetting and moisture absorption. Store roofing and flashing materials on clean raised platforms with weather protective covering when stored outdoors.

I. Store rolled goods on end. Thermoplastic membrane only rolls shall be laid flat.

J. Protect materials against damage by construction traffic.

K. The proper storage of materials is the sole responsibility of the contractor and any wet or damaged roofing materials shall be discarded, removed from the project site, and replaced prior to application.

L. Comply with fire and safety regulations, especially with materials which are extremely flammable and/or toxic. Use safety precautions indicated on labels.

M. Products liable, such as emulsions, to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

N. 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.

O. The contractor is to erect a temporary chain link fence, minimum six feet (6') in height, around work area stage and kettles. Fence is to be secured on a daily basis.

1.09 SITE CONDITIONS

A. Job Condition Requirements:
1. Coordinate the work of the contractor with the work to be performed by other trades, to ensure proper sequencing of the entire work. The contractor is to schedule his work so that adequate time is allowed for other trades to perform their work.
2. Apply roofing in dry weather.
3. Do not apply roofing when ambient temperature is below 45° F.
4. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with specifications.
5. Schedule the work so the building will be left watertight at the end of each day. Do not remove more roofing materials than can be reinstalled in any working day.
6. Load placed on the roof at any point shall not exceed the safe load for which the roof is designed.
7. All surfaces to receive new roofing shall be smooth, dry, and free from dirt, debris, and foreign material before any of this work is installed. Competent operators shall be in attendance at all times equipment is in use. Materials shall be stored neatly in areas designated by the Architect.

8. The contractor is to be aware of the potential for roof leaks on the existing roof as a result of ruptured blisters and/or roof mat damage caused by the vacuum process, foot traffic, or material and equipment storage. The contractor is to take all necessary precautions to prevent damage to the existing roof. All damage to the existing roof that could result in roof leaks is to be repaired on a daily basis by the roofing contractor.
9. The contractor shall follow local, state, and federal regulations, safety standards, and codes for the removal, handling, and disposal of asbestos containing materials, if present. When a conflict exists, follow the stricter document.
10. Due caution should be exercised so as not to alter the structural integrity of the deck. When cutting through any deck, care should be taken so as not to damage the deck or any part of the deck, such as post tension cables, etc.
11. All kettles shall have a fume recovery system, automatic thermostat control, and visible temperature gauge all in working order.
12. The contractor is to verify the location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. The contractor is to perform all work in such a manner as to avoid contact with the above mentioned items.
13. Surface and air temperatures should be a minimum 45° F during applications of cleaner and waterproof coating and remain above 45° F for a minimum of four (4) hours following applications. Verify compatibility of cleaner with coatings, paints, primers and joint sealers specified. Advise Architect of any problems in this regard prior to commencing cleaning operations.
14. Temporary Sanitary Facilities:
    a. The contractor shall furnish and maintain temporary sanitary facilities for employees use during this project, including temporary toilets, wash facilities, and drinking water fixtures. Sanitary facilities shall be secured to prevent tipping or movement.
    b. Toilet units shall be self-contained, single-occupant, of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
    c. Facilities shall be installed where they will best service the project's needs, with Owner's/Owner's Representative's approval.
    d. Contractor shall provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
    e. All portable facilities shall comply with local laws, codes, and regulations.
    f. Contractor shall be responsible to see that the units are removed in a timely manner after the completion of the project.

B. Protection of Work and Property:
1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. Contractor shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations pertaining to asbestos as required shall be fulfilled by the contractor as part of his proposal.

2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows: a) removal, protection, preservation, or replacement and replanting of plant materials; b) protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.
3. Finished roof areas shall be protected from damage by the contractor during construction.

C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds must be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

E. Use of Premises:
1. The contractor is advised that the Owner will occupy the building at all times, and the contractor must provide all safeguards required to protect personnel and to keep noise levels as low as reasonably possible for each operation.
2. The contractor shall:
   a) Coordinate work in such a manner as to not interfere with the normal operation of the building.
   b) Assume full responsibility for protection and safekeeping of products stored on premises.
   c) Agree to hold the Owner harmless in any and all liability of every nature and description which may be suffered through bodily injuries, including death of any persons by reason of negligence of the contractor, agents, employees, or subcontractors.

F. Cleaning and Disposal of Materials:
1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.
2. 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. A suitable scrap chute or hoist must be used to lower any debris. At completion, all work areas shall be left broom clean and all contractor's equipment and materials removed from the site.
3. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.
4. Debris shall be deposited at an approved disposal site.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate roofing schedule with work of other trades.

B. Plan lay up of roofing membrane with respect to deck slope. Avoid situations where excessive drainage could pass into completed roofing.

C. Maintain communication with roofing manufacturer's representative to inform of progress and to schedule periodic inspections.

D. All penetrations shall be made in roof prior to beginning with roof installation.

1.11 PERFORMANCE REQUIREMENTS

A. Roofing System: Shall prevent water migration into roof assembly or building interior through the roof membrane and/or membrane base flashing.

B. Wind Uplift: In accordance with ASCE-7 requirements and designed wind pressures.

C. Roof Surface: Provide finished roofing membrane with minimum three-year total solar reflectance of 0.7 and three year thermal emittance greater than 0.8 when tested in accordance with the following:
1. Reflectance: Measured in accordance with ASTM C1549-02, ASTM E903, or ASTM E1918.
2. Emittance: Measured in accordance with ASTM C1371, or ASTM E408.

D. Flashings and Fastening: Comply with requirements of Section 07 62 00 - Sheet Metal Flashing and Trim. Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
1. ANSI/SPRI ES-1 for Perimeter detail, metal edges and copings.
2. NRCA Roofing and Waterproofing Manual for construction details and recommendations.
3. SMACNA Architectural Sheet Metal Manual for construction details.

1.12 QUALITY ASSURANCE

A. Work of this Section to conform to these specifications, and to the roofing material manufacturer's application instructions. In the event of conflicts between the two, the more stringent requirement shall be observed.

B. Maintain one copy of each document on site.

C. Factory Technical Representative: Roofing Contractor is to arrange and schedule the manufacturer's technical representative to be on site the first day of the installation of manufacturer's roofing system. The manufacturer's technical representative shall inspect the work of the contractor at least one time each week during the installation of the roofing system. The manufacturer's technical representative shall perform with the owner's representative and the roofing contractor a final inspection of the roofing system. At the completion of the final inspection, provide to the roofing contractor a list of punch list items (if any) to be correct before technical acceptance of the roofing project and prior to issuance of manufacturer's Twenty (20) Year Full System Warranty (Edge to Edge). Field reports shall be provided after each inspection within five (5) days of site visit.

D. Pullout Tests: Conduct pullout test on deck using appropriate fastener prior to roof system installation. Submit pullout results for manufacturer's review to determine specific fastening pattern for this project, minimum uplift requirements shall conform to current ASCE 7 criteria.

1.13 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of the products specified, with five (5) years documented experience in the uninterrupted, and unmodified manufacture of the roofing system and component elements of the roofing system specified herein.

B. Applicator: Company specializing in the work of this Section, having a minimum of five (5) years documented experience applying modified bitumen roofing systems, and approved by the Manufacturer for not less than three (3) years to install the specified roof system so as to achieve a twenty (20) year no dollar limit warranty.

1.14 REGULATORY REQUIREMENTS

A. Conform to all applicable local codes for roof assembly fire hazard requirements.

B. Provide certification of inspection confirming approval of design and installation by authority having jurisdiction.

C. Fire Hazard Classifications: UL Class A.

1.15 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference two weeks prior to commencing the Work.

B. Require attendance of parties directly affecting the Work of this Section.

C. Review condition of roof deck and installation, installation procedures and coordination with related work.

1.16 ENVIRONMENT REQUIREMENTS

A. Do not apply roofing during inclement weather.

B. Do not apply roofing membrane to damp or frozen deck or substrate.

1.17 WARRANTY

A. Roofing - Manufacturer: Project shall be installed in such a manner that the roofing material manufacturer will furnish a written twenty (20) Year NDL with no exclusion for 2" hail occurrence and wind speeds up to 155 mph

B. Warranty: The complete roofing system (from top of deck/substrate up) shall be guaranteed for a minimum of twenty (20) years from the date of Substantial Completion for this project. Guarantee responsibilities shall be as follows:
   1. The manufacturer's warranty will include a 120 mph Wind Rider for the field of the roof and a 155 mph Wind Rider for the perimeter metals as supplied by the roofing system manufacturer.

C. Roofing - Contractor: The 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 two (2) year warranty period, after the Owner accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the contractor and his subcontractors, if any, to make good the requirements of the warranty.

D. The materials manufacturer shall guarantee the entire roofing system as supplied by system manufacturer for a total period of twenty (20) years from the date of substantial completion.

E. Membrane manufacturer shall provide the written warranty as specified.

F. The entire roofing system (from top of deck/substrate up) shall be guaranteed to be watertight and against any failures of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.

G. Warranty repairs shall be performed by a certified installer. The repairs shall be performed in accordance with the manufacturer's written instructions and recommended procedures so as to not void the warranty.

H. During the proposal period each Contractor shall make arrangements with the materials manufacturer to provide the required warranty. Refer to SUBMITTALS paragraph in this section for requirements concerning submittals of warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. Compatibility: Provide materials that are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

B. Materials herein specified shall be supplied or approved in writing by the manufacturer issuing the warranty.

C. The white polyester reinforced fleece backed adhered roofing system shall only be applied by manufacturer approved and trained roofing contractors.

D. The manufacturer shall have 15 years UL listing for the membrane to be used on the project. Membrane manufacturer shall have a minimum of 15 years FM approval, and 15 years manufacturing experience with the roofing membrane specified for this project.

E. All roofing and roof accessories shall be installed in compliance with manufacturer's current specifications and details.

F. All materials used on the project shall be asbestos free.

2.02 ROOFING MEMBRANE

A. Field roof membrane shall be a white polyester reinforced fleece-backed Elvaloy membrane as manufactured by: Johns Manville, Carlisle or Fibertite.

B. 80 mil Membrane shall have the following minimum physical property values:

Property	Test Method	Specification
Color		White
Thickness	ASTM D751	.087”
Thickness over scrim	ASTM D7635	.040"
Breaking Strength (lbf)	ASTM D751	325 x 324
Tear Strength (lbf)	ASTM D751	89 x 109
Seam Strength (lbf)	ASTM D751	295
Elongation	ASTM D751	50% x 42%
Heat Aging	ASTM D3045	> 90 %
Low Temp. Bend	ASTM D2136	Pass (-40°F)
Static Puncture Resistance	ASTM D5602	Pass
Dynamic Puncture Resistance	ASTM D5635	Pass
Permeance	ASTM E96	0.003 Perms
Dimensional Stability	ASTM D1204	0.3%
Weight change after Water Immersion	ASTM D570	1.20%
Accelerated Weathering	ASTM G155	Pass
Fungi Resistance	ASTM G21	No Growth
Solar Reflectivity	ASTM C1549	82% (White)
Emissivity	ASTM C1371	.91 (White)
SRI	ASTM E1980	109 (White)

2.03 BASE FLASHING MEMBRANE

A. The flashing 60 mil membrane shall be a white polyester reinforced flexible sheet.

Property	Test Procedure	Physical Properties
Color		White
Thickness	ASTM D 751	60 mil Nominal
Breaking Strength	ASTM D 751	298 x 278 lbf
Seam Strength	ASTM D 751	286 lbf
Tear Strength	ASTM D 751	89 x 109 lbf
Elongation	ASTM D 751	35% x 34%
Heat Aging	ASTM D 3045	>90%
Static Puncture Resistance	ASTM D 5602	Pass
Dynamic Puncture Resistance	ASTM D 5635	Pass
Low Temperature Bend	ASTM D 2136	Pass – (40°F)
Permeance	ASTM E 96	0.003 Perms
Dimensional Stability	ASTM D 1204	0.3%
Wt. Change after Immersion	ASTM D 570	1.20%
Accelerated Weathering	ASTM G 155	Pass
Fungi Resistance	ASTM G 21	Pass
Solar Reflectivity	ASTM C 1549	0.82
Solar Emissivity	ASTM C 1371	0.91
Solar Reflectance Index (SRI)	ASTM E 1980	109
Underwriters Laboratory		Class A
Factory Mutual		Class 1-90

2.04 NON-REINFORCED MEMBRANE

A. The non-reinforced membrane shall have the following minimum properties:
   1. Description: Non-reinforced thermoplastic white membrane, thickness approximately 45 mils.
   2. Use: Inside / Outside corners, multi angled intersections, sealant pockets, and other conditions where molding of the membrane is required.

2.05 BITUMEN

A. Shall be ASTM D 312 Type IV steep asphalt.

Slope	Interply	Top Pour	Backnail	Strap
0 - ½" per 12"	Type IV	Type IV	No	No
½" - 2" per 12"	Type IV	Type IV	Yes	Strap if Possible
2" - 3" per 12"	Type IV	Type IV	Yes	Yes

B. Shall be Low Fuming Perma Mop ASTM D 312-15 modified asphalt, and as acceptable by roofing manufacturer to comply with warranty requirements.

2.06 CAULKS

A. Sealant for use at coping joints, reglet joints, etc., shall be a one-component urethane non-sag, gun grade sealant designed for use in active exterior joints, and shall meet or exceed Federal Specification No. 1 TT-S-00230C, Type II, Class A, ASTM C 920. Where joint surfaces are contained or are contaminated with bituminous materials, provide manufacturer's modified-type sealant (modified with coal-tar or asphalt as required), or approved equal.

B. To seal the leading edge of the membrane, to bond membrane at terminations with metal, and for open seam repair, sealant shall be a thermosetting, solvent free, non-slump, self-fixturing, multipurpose structural sealant which shall meet the following physical and performance properties, M-1 as manufactured by Chem Link Inc., or approved equal.

Properties	
Specific Gravity	1.62 (13.5 lbs./gallon)
Viscosity	800,000 cps Brookfield RTV, TF spindle, 4 rpm 70° F.
Shear Strength (ASTM D-1002)	300 psi+ (7 day ambient cure)
Elongation @ break (ASTM D-412)	300% (7 day ambient cure)
Hardness Shore A (ASTM C-661)	50 – 55 (14 day ambient cure)
Tack free time (ASTM C-679)	35 minutes
Low temperature flex	-20° F: PASS
Slump (sag) (ASTM C-639)	Zero slump
Shrinkage (ASTM D-2453)	No measurable shrinkage (14 cay cure)
Service temperature	-40° F to 200° F

2.07 BASE PLY SHEET MEMBRANE

A. Shall be nominal eighty-five (80) mil, smooth surfaced, SBS modified asphalt glass reinforced base sheet coated with flexible, SBS polymer-modified asphalt , meeting ASTM D6163, Type 1, Grade S.

2.08 INSULATION

A. All insulation shall be in compliance with Section 07 2216 Roof Board Insulation.

B. All insulation shall be supplied by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application, Underwriters Laboratory approved

2.09 SUBSTRATE BOARDS

A. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

2.10 CANT STRIP

A. Structural: Shall be wood where used for structural purposes meeting NRCA, FM Global and Underwriters Laboratory guidelines.

B. Non-structural: Shall be wood fiber where used for non-structural purposes, conforming to ASTM C208 and C209.

2.11 ROUGH LUMBER

A. Refer to Specification Section 06 1053 Miscellaneous Carpentry for further information

B. All wood nailers, structural cants, curbs, and other miscellaneous rough carpentry, shall be lumber as recommended by NRCA, and Underwriters Laboratory guidelines.

C. Vertical Wall Shimming Material: Shall be exterior grade plywood unless otherwise accepted by Architect. Thickness shall be as required for attachment or to make material flashing flush or level with offsets and/or transitions, minimum three-fourths inch (3/4"). Proper selection of material is required to achieve UL guidelines.

D. Where plywood is not used on the back of the parapet contractor to provide a continuous 22 ga. Sheet metal strap over the face of the studs at the through wall flashing location to accommodate the flashing fasteners.

2.12 FASTENERS AND PLATES

A. Fasteners and fastening plates or bars shall be supplied by the membrane manufacturer for the specific application.

B. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

2.13 BONDING ADHESIVE FOR FLASHING

A. Description: Adhesive is a bonding cement of synthetic rubber for adhering membranes to various substrates. Shall be Supplied by the membrane manufacturer.

Typical Liquid Properties (Room Temperature)	
Color	Amber/Yellow
Base Product	Neoprene
Solids	25%
Specific Gravity	.87
Pounds/Gallon	7.25
Viscosity (CPS)	2500
Solvents	Ketone, Toluene, Aliphatic Hydrocarbon, Zylene
Estimated Coverage	
2 Sided Application	55/70 sq. ft. (2/2.5 mils dry)
DOT Label Required	Flammable Liquid
Code - 584661	

B. Handling: Contains ingredients which could be harmful if mishandled. Contact with skin and eyes should be avoided and necessary protective equipment and clothing should be worn.

2.14 ASPHALT ROOF PRIMER

A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces, Shall be Supplied by the membrane manufacturer

Applicable Federal Specification	SS-A-701B
ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.15 TRIM STRIP

A. The trim strip shall have the following minimum properties, Shall be Supplied by the membrane manufacturer
   1. Six inch (6") wide non-reinforced 45 mil thermoplastic used for capping butted ends of rolls.
   2. The trim strip is seamed with the use of hot-air welding.

2.16 CORNERS

A. Inside and outside corners shall be supplied by the membrane manufacturer and shall be of the same base material as the roof membrane.

2.17 PIPE BANDS

A. Stainless steel bands with self-locking heads.

B. Tighten with hand tool for tension control and flush cut off.

2.18 PRE-MOLDED BOOTS

A. Non-reinforced thermoplastic tapered molds for various pipes, heat welded to field membrane and sealed at top with stainless steel pipe bands and seam sealer.

2.19 PITCH PAN SEALANT

A. Shall be one-part, self-leveling polyurethane sealant meeting Federal Specification No. TT-S-00230C, Type I, Class A, ASTM C 920, Type S, Grade P, Class 25, for use in new pitch pans, Shall be Supplied by the membrane manufacturer

2.20 PIPE SUPPORTS

A. Pipe support system shall be a prefabricated, engineered support system designed specifically for use on roofing without adhesive, roof penetrations, flashings, or damage to roofing system. Supports shall be as recommended by manufacturer as suitable for size and type of conduit or pipe being supported or approved equal.

B. Refer to Specification Section 07 7200 Roof Accessories for further information.

2.21 LEAD FLASHING DRAINS

A. Shall be four pound (4#) lead, minimum thirty-six inches by thirty-six inches (36" x 36"), used for flashing of internal drains.

2.22 WALKWAY PAD

A. The walkway pad shall have the following minimum physical properties, and be applied with edges heat or solvent welded, Shall be Supplied by the membrane manufacturer.

Property	Test Procedure	Physical Properties
Color		Gray
Size		36" wide x 60' long
Thickness	ASTM D 638	.080" nominal
Reinforcement		1000 Denier Polyester
Tear Strength	ASTM D 751	210 X 200 lbf
Puncture Resistance		96 lbs
Cold Resistance	ASTM D 1043	-40° C
Shore A Durometer		85
Hydrostatic Resistance		400 psi
Dimensional Stability	ASTM D 1240	≤ 1%
Ultraviolet Stability		12,000 hrs. Excellent

2.23 ROOF PLAQUE

A. Contractor shall provide a sixteen inch by sixteen inch (16” x 16”) metal plaque on the underside of each of the roof hatches that states the following:
1. Architect name, phone number.
2. School district phone number.
3. School district emergency phone number.
4. Contractor name, phone number.
5. Subcontractor name, phone number.
6. Roof Consultant, name, phone number.
7. Roof system warranty information, and
8. Roof Manufacturer, phone number.

2.24 TERMINATION/PRESSURE BARS

A. Aluminum strip shall be extruded channel bar with a mill finish, width one inch (1"), thickness 0.100" ± .008", leg height one-fourth inch (1/4") top and bottom, leg angle ninety degrees (90°), for perimeter and curb anchorage, having predrilled holes six inches (6") on center, Shall be Supplied by the membrane manufacturer.

2.25 T- JOINT COVERS

A. Supplied by the membrane manufacturer as a secondary covering to all T – Joints in the installation of thermoplastic roof systems consisting of waterproofing coverings equal to or greater than 60 mils in thickness.

2.26 ELASTOMERIC SEALANT

A. Multi-Component Polysulfide Sealant: Except as otherwise indicated, provide manufacturer's standard, non-modified, 2-or-more-part, polyurethane-based, elastomeric sealant; complying with either ASTM C 920, Type M, Class 25, or FS TT-S-00227E, Class A; self-leveling grade/type where used in joints of surfaces subject to traffic, otherwise non-sag grade/type, as manufactured by Sonneborn, or approved equal.

B. Durability: Less than 0.5 square inch adhesion/cohesion loss for three (3) samples of both mortar and aluminum; ASTM C 719 test procedure.

C. Adhesion in Peel: Fifteen pound (15#) peel strength and 10% maximum loss of bond to substrate; ASTM C 794.

D. Bituminous Modification: Where joint surfaces contain or are contaminated with bituminous materials, provide manufacturer's modified type sealant which is compatible with joint surfaces (modified with coal-tar or asphalt as required).

2.27 EXPANDED POLYETHYLENE JOINT FILLER

A. Provide flexible, compressible, closed-cell, polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants, surface water absorption of not more than 0.1 pounds per square foot, as manufactured by Sonneborn, or approved equal.

2.28 DELIVERY AND STORAGE

A. All materials shall be delivered with appropriate carton and can labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

2.29 PRECAUTIONS

A. Some of the indicated materials are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

2.30 MISCELLANEOUS MATERIALS

A. Other materials shall be as specified, or of the best grade for the proposed use, as recommended by the manufacturer of said product.

2.31 EXPANSION JOINTS

A. Provide field fabricated wood expansion joints where shown on the drawings in size as indicated and acceptable to authorities having jurisdiction.

B. Expansion joint nailers shall extend upward a minimum of eight inches (8") above finish roof height.

C. Existing expansion joints shall be replaced with curbed expansion joints which extend a minimum of eight inches (8") above the finished roof surface. New expansion joint cover shall be fabricated of sheet metal in accordance with NRCA and/or SMACNA details and flashed in accordance with roofing material manufacturer's recommended procedures.

D. Expansion joints at walls and field of the roof shall be curbed as outlined in accordance with NRCA and SMACNA guidelines. The curbs will be flashed as outlined above in Curb Flashings.

E. Provide structural expansion joint in the field of the roof where the roof span exceeds 200’-0” in any direction.

2.32 VERTICAL WALL SHIMMING MATERIAL

A. Shall be one of the following unless otherwise accepted by Owner's representative: OSB, exterior grade plywood, gypsum core board or concrete core board. Proper selection of material is required to achieve FM Global and UL guidelines.

2.33 SELF-ADHERING UNDERLAYMENT FOR TEMPORARY WATERPROOFING

A. A premium heavyweight, minimum 60 mil, high temperature (260 degree) self-adhering underlayment, to use as a temporary waterproofing barrier.

2.34 OVERNIGHT SEAL

A. Hot applied asphalt bitumen shall be provided for the purpose of night sealing the roof system.

PART 3 - EXECUTION

3.01 REFERENCE

A. The manufacturer's Technical Specifications shall be considered a part of this specification and should be referred to for more specific application procedures and recommendations.

B. Application of materials shall be in strict accordance with the manufacturer's recommendations except where more stringent requirements are shown or specified. In the instance of a conflict between these specifications and those of the manufacturer, the more stringent specifications shall take precedence.

C. General Installation:
1. Protect adjacent areas with tarpaulin or other durable materials.
2. Contractor shall prevent overspray, and be responsible for parking lot areas and/or adjoining areas not part of this contract.
3. Contractor 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 applicator'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. Any prefinished sheet steel that is to receive bitumen, or come in contact with bitumen or adhesive, shall be scored, scuffed or abraded prior to receiving primer.
5. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
6. All surfaces/substrates shall be clean and dry prior to application of materials.
7. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the insulation and/or substrate. Gravel or debris between the insulation/substrate and plies is not acceptable.
8. Bitumen kettle shall have a visible thermometer and thermostatic control or some other means to provide positive monitoring of the bitumen temperature when it is heated in accordance with manufacturer's instructions.
9. Ambient temperature shall be 45° F and rising.
10. The maximum heating temperature of Type III asphalt shall be 500° F.
11. The temperature of Type III asphalt shall be approximately 430° F ± at the point of application or as recommended by the membrane manufacturer.
12. Maintain kettle and/or tanker temperature at least 25° F below the actual flash point of the bituminous materials used.
13. Never heat the bituminous materials at high temperatures for prolonged periods of time.
14. Do not allow bituminous materials to stand in luggers for long periods.
15. Circulate bituminous materials.
16. Insulate hot transport lines if required.
17. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying membrane.
18. Where deteriorated base flashing is removed, primed cant strips shall be installed at the intersection of the deck and the vertical surfaces. All flashings shall be mechanically top-fastened with a termination bar a minimum of six inches (6") on center at the top leading edge, and be a minimum of eight inches (8") in height from finished membrane.
19. Provide a water test of each roof section prior to substantial completion. The test should simulate rainfall of one inch (1") per hour minimum.
20. On slopes greater than one inch (1") in twelve inches (12"), refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
21. Provide watertight tie-in as necessary daily.

3.02 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive the Work of this Section.

B. Verify that deck is secure, that it is clean and smooth, free of depressions, waves, abrupt elevation change, protrusions, or projections and properly sloped to drains.

C. Verify that deck surfaces are dry and free of frost, dew or other moisture.

D. Verify that roof openings, curbs, sleeves and vents through the roof are solidly set and ready to receive this Work.

3.03 SUBSTRATE PREPARATION

A. Substrate shall be smooth and free of debris, sharp edges, and other surface irregularities prior to work starting. Substrate repair shall be performed as required to minimum of NRCA standards.

B. Metal Decks – New Construction:
1. All loose rust, bitumen, or other foreign material shall be removed from the deck before applying asphalt primer at the minimal rate of one and one-half (1-1/2) gallons per one hundred (100) square feet of area.
2. The deck span shall not exceed that recommended by FM Global Bulletin 1-28.
3. Expansion/control joints shall be installed so that no one area exceeds two hundred feet by two hundred feet (200' x 200').

b) Pour the bitumen on the surface of the deck. If the bitumen foams, the deck is NOT dry enough to roof.
c) After the bitumen has cooled, an attempt should be made to strip the bitumen from the deck surface. If the bitumen strips clean from the deck, the deck is NOT dry enough to roof.

4. Prestressed, precast concrete slabs require the following preparation:
a) If there is a screeded fill over the slabs, the joints of the slabs should be left open.
b) If screeded fill is not used to cover the slabs, the joints of the slabs shall be sealed with an elastomeric sealant.
c) After priming, six inch (6") wide .072 inch self-adhered coal-tar elastomeric membrane strips shall be applied over each joint in the deck before laying the venting base sheet.
d) Before applying the membrane strips to the joints, a leveling fill of quick-setting mortar must be used whenever slab edges are out of plane by more than one-half inch (1/2").

3.04 ASPHALT HEATING

A. Use low burner flames during initial melt-downs. Circulate asphalt after initial melt-down.
1. Maximum asphalt temperature shall be 25°F below the flash point.

B. Avoid prolonged heating of asphalt at high temperatures. Reduce the asphalt temperature to below 500°F if asphalt is not being used for periods of four (4) hours or more.

C. Kettle shall be free of contaminants.

D. Application rates: Bitumen quantities for water stop/tie-offs, flashings, miscellaneous detail applications, and minimum kettle capacity are not included in application rates. To account for these factors, add approximately 25 percent additional bitumen on a total job average basis.

3.05 ROUGH CARPENTRY

A. All rough carpentry shall be in compliance with Section 06 1053 Miscellaneous Carpentry.

B. Nailers shall be installed according to NRCA, Underwriters Laboratory, and IBC guidelines.
C. Wooden nailers shall be installed at Metal edges, drip edges, expansion joints, and on outside perimeter of building.

D. Metal Edge and drip edge nailers shall be the same height as the new insulation being installed where required.

E. Nailers shall be raised if necessary by anchoring an additional nailer of appropriate height to the existing nailer if the existing nailer is not to be replaced.

F. Expansion joint nailers shall extend upward a minimum of eight inches (8") above finish roof height.

G. Where parapet wall exists, specified vertical wall shimming material shall be installed beginning at roof height up to a minimum of twelve inches (12”) above finished roof surface, or as detailed, to provide substrate for horizontal termination of roof to wall flashing system.

H. Any lumber or shimming required for attachment, or to make material flashing flush or level with offsets and/or transitions, shall be incorporated in these specifications.

3.06 CANTS

A. Provide full 45 degree cant strips (no partials) at all intersections of vertical and horizontal surfaces, such as walls, parapet walls, curbs, expansion joints, etc., and as recommended by membrane manufacturer.

B. Cants shall provide a four (4) inch rise above the roof’s surface.

C. Toe of cant shall be level with the surface to receive new roof membrane and in all cases anchored according to NRCA, Underwriters Laboratory, and IBC guidelines.
D. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.

E. If a wood cant is used where insulation exists, cant shall be toe nailed into treated wood nailer under cant the same height as insulation.

3.07 INSULATION

A. All insulation shall be in compliance with Section 07 2216 Roof Board Insulation.

B. 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, Underwriters Laboratory approved

3.08 SUBSTRATE BOARDS

A. All substrate boards shall be in compliance with Section 07 2216 Roof Board Insulation.

3.09 APPLICATION OF BASE PLY SHEET

A. Base Ply Sheet to be adhered as follows:

Base ply sheet shall be solid mopped at the nominal rate of thirty pounds (30#) ± 20 percent per one hundred (100) square feet using asphalt Type III as required by slope, properly heated. Specified layers shall be applied in accordance with the manufacturer's recommendations and in accordance with general practices as set forth by the NRCA Roofing Manual.

1. (Note: If base ply sheet is to be left exposed to the elements for more than 30 days, the top ply must be glazed coated with a solid mopping of Type III asphalt at the nominal rate of thirty pounds (30#) per one hundred (100) square feet.

3.10 HOT APPLIED FLEECE BACKED MEMBRANE

A. Adhered Application: Adhere membrane to acceptable substrate with hot asphalt applied at the rate specified by the manufacturer.
1. The roof surface must be clean, dry and free of foreign material.
2. Position sheets as indicated on approved shop drawings.
3. Fold one end of the sheet on top of itself until both ends meet. Apply hot asphalt to the prepared roof surface. The sheet can then be pulled and laid into the bonding material using care not to create any wrinkles.
4. Carefully push into place from fold line to overlap, avoiding wrinkles and air pockets. Roll membrane flat with a roller that weighs a minimum of 100 lbs.
5. Repeat procedure for other sheet half.
6. Due caution when rolling in sheet goods to not leave footprints in the embedded sheet good.
7. Lap seams shall be done by lapping the two inch (2") selvedge edge over the non-selvedge edge of the previous roll. The selvedge edge seam shall be made with the heat gun method.
8. Roll ends are butted together and capped with a six inch (6") wide trim strip. The trim strip is then seamed with the heat gun.
9. T-Joint covers are required over all t joints on installations of thermoplastic roofing membranes equal to or greater than 60 mils in thickness. Center T-Joint cover over the t-joint and completely hot air weld the cover to the field membrane.

B. Lap Seaming Procedure: Overlap membrane for attachment method specified and hot-air welded with manufacturer's approved equipment.

1. All surfaces to be weld shall be clean, dry and free of foreign material.
2. All seams must then be checked with a needle probe and any voids repaired with the heat gun.
3. All seams are to be probed daily (NO EXCEPTIONS)

3.11 FLASHING - GENERAL

A. Flash all penetrations, metal edge systems, walls, curbs, expansion joints, drains as shown on details and approved shop drawings.
   1. Use prefabricated flashing accessories or components such as sealant pockets, premolded vent/pipe flashing.
   2. Mechanically fasten flashing at terminations according to approved details.
   3. Fastening membrane flashing through metal counterflashing is not acceptable.

B. Any lumber or shimming required for attachment or to make material flashing flush or level with offsets and/or transitions shall be incorporated in the flashing specifications.

3.12 BASE FLASHING (APPROXIMATELY 8" IN HEIGHT MINIMUM)

A. Base flashings shall be installed using the flashing membrane, with length of run not to exceed twenty linear feet (20').

B. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck.

C. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.

D. The roofing field membrane shall extend up over and two inches (2") above the top of cant strips at all vertical intersections or out to the roof's edge.

E. All existing substrates receiving flashing membrane shall be clean and primed with primer, prior to application as required.

F. All flashings shall be mechanically fastened with a termination bar a maximum of six inches (6") on center, be a maximum of eight inches (8") above finished roof height, extend a minimum of four inches (4") onto the field of horizontal roof membrane, and not exceed twenty linear feet (20') of run in length.

G. After proper termination of the base flashing at a minimum eight inch (8") height (or maximum eighteen inch (18") height), a saw cut reglet with counterflashing shall be installed according to NRCA and SMACNA guidelines.

H. All vertical flashing lap seams of the flashing membrane shall be hot-air welded.

I. All flashing membrane shall be adhered with flashing bonding adhesive to the vertical substrate and hot-air welded to the field of roof membrane; hot-air weld vertical laps.

J. Flashing laps shall be minimum two inch (2") width, no maximum. Hot-air weld of flashing lap shall be minimum two inch (2") width, no maximum.

K. Hot-Air Welding of Flashing Laps:
1. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application; therefore, these parameters should be set by trial and error using two (2) pieces of the flashing membrane. Minimum width of hot-air weld two inches (2"), no maximum.
2. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
3. Allow the seams to set fully, and probe the entire length for voids. Reseam voids immediately with a hot-air gun and roller.

L. All hot-air welded seams/laps shall be tested daily with a probe for integrity, no variance.

3.13 VERTICAL WALL FLASHING (FOR USE APPROXIMATELY 8-18" ABOVE THE FINISHED ROOF LINE AND EXTENDING UPWARD)

A. Flashing membrane shall be installed on the vertical beginning a minimum of eight inches (8") above the finished roof line (where the base flashing is terminated), with length of run not to exceed twenty feet (20'). Flashing shall be installed in strict accordance with the manufacturer's recommendations.

B. The termination bar used to terminate the minimum eight inch (8") high base flashing shall be used to terminate the lower edge of the vertical flashing. This will cause the termination bar to be buried at the termination point. Care should be taken to ensure the top edge of the base flashing and bottom edge of the vertical flashing are both secured.

C. All existing substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.

D. All substrates receiving welded-seam flashing membrane shall be clean and primed with primer, prior to application when applicable.

E. The vertical wall flashing membrane shall be set in flashing bonding adhesive according to manufacturer's guidelines.

F. All vertical flashing lap seams of the flashing membrane shall be hot-air welded.

G. Flashing laps shall be minimum two inch (2") width, no maximum. Hot-air weld of flashing lap shall be minimum two inch (2") width, no maximum.

H. Immediately following the laying of the flashing membrane, it shall be pressed or rolled in the width direction of the membrane. This will prevent excessive entrapment of air beneath the membrane. The pressing or rolling shall be in the width direction and with the laps so as not to buck the laps.

I. Any flashing extending further than eighteen inches (18") up onto a vertical surface shall be installed using the strapped method and must be fastened with a termination bar or installed up and over the parapet wall and fastened to the nailer on the outside of the wall.

J. The flashing membrane shall be run up the wall in sheet widths, run under the coping cap and be terminated on the outside of the wall six inches (6") on center; then the coping cap shall be reset. All side laps are to be hot-air welded.

K. Hot-air Welding Laps:
1. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application, therefore, these parameters should be set by the contractor by using two (2) pieces of flashing membrane. Minimum width of hot-air weld shall be two inches (2").
2. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
3. Allow the seams to set fully, and probe the entire length for voids. Reseam voids immediately with a hot-air gun and roller.

L. All hot-air welded seams/laps shall be tested daily with a probe for integrity, no variance.

M. Any lumber or shimming required for attachment or to make material flashing flush or level with offsets and/or transitions shall be incorporated in the flashing specifications.

3.14 PERIMETER FASTENING

A. Wood nailers are required for perimeter gravel stops or drip edges. Field membrane and all plies shall be mechanically fastened on the vertical face of nailer, twelve inches (12") on center maximum.

3.15 EDGING FLASHINGS

A. An NRCA-approved gravel stop/fascia system shall be installed in strict accordance with published instructions to meet ES-1.

3.16 PIPING/CONDUIT

A. To support conduit or pipe sized up to Ø8" when height adjustment is needed use Model # SS1000A Adjustable Pipe Support. 17" circular base with 12 ga. framing channel, 18"L, attached to 17" circular base using ½" threaded rods, 12"L, with washers and nuts. Height of channel can be adjusted along the length of the ½" threaded rods. Strut clamps are suggested to hold piping or conduit in place.
1. Manufacturers:
a) Advanced Support Products, Inc.

B. To support water or gas piping up to Ø8" or when a roller support with height adjustment is needed use Model # SS1000RA Pipe Support with Adjustable Roller. 17" circular base with SBR heavy duty rubber roller assembly attached to 17" circular base using ½" threaded rods, 12"L, with washers and nuts. Height of roller assembly can be adjusted along the length of the ½" threaded rods.
1. Manufacturers:
a) Advanced Support Products, Inc.

C. To support multiple pipe runs, piping up to Ø12" when height adjustment or pipe suspension is needed use Model # SS4000P, SS6000P or SS8000P Adjustable Support Bridge. SS4000P Adjustable Support Bridge is made of four (4) 17" circular bases and 12ga. framing channel formed to make one “H” shaped support with crossbar. SS6000P Adjustable support Bridge is made of six (6) 17" circular bases and 12ga. framing channel formed to make two “H” shaped supports with crossbar. SS8000P Adjustable support Bridge is made of eight (8) 17" circular bases and 12ga. framing channel formed to make three “H” shaped supports with crossbar. Crossbar height is adjustable and offered in 18", 24", 36", and 48" lengths. Use Adjustable Support Bridge with strut clamps or roller accessories or use optional hanger supports to suspend water or gas piping at various heights. Optional hanger supports attached to support frame using ½" threaded rods. Hangers offer complete height adjustments along the length of ½" threaded rods.
   1. Manufacturers:
      a) Advanced Support Products, Inc.

D. All gas lines, piping, and conduits shall be coated with industrial grade yellow pain

3.17 DRAINS

A. All roof drains shall be in compliance with Division 22- Plumbing.

3.18 DRAIN FLASHINGS

A. Build a sump to the drain and create a smooth transition by installing tapered insulation around the drain. The slope of the drain sump shall not exceed one inch (1") per horizontal foot (8%). The drain sump should be eight foot by eight foot (8' x 8') sump minimum per roof plans.

B. All drains shall receive new lead flashings. Flashings shall be installed in strict accordance with manufacturer's recommendations and with practices as set forth in the NRCA Roofing Manual.

3.19 EXPANSION JOINTS

A. Expansion material shall be formed and centered over the roof to roof structural EJ locations as shown on the drawings.

B. Coordinate the location of the expansion joint framing with Structural, Architectural and Roof drawings.

C. Framing of the expansion shall be in accordance with the details and as field conditions dictate.

D. Expansion material shall be formed and located adjacent to roof to rise wall structural EJ locations as shown on the drawings.

E. Wood Cants shall provide a four inch (4") rise above the roof's surface and extend a minimum of four inches (4") horizontally.

F. Vertical wood framing shall be attached over horizontal wood blocking as shown and detailed.

G. Taper the top of the expansion join as required at tapered roof areas to maintain a minimum height of 8" above finished roof surface.

H. Provide a field-built wood, structural expansion joint in the field of the roof where the roof span exceeds 200'-0" in any direction.

3.20 WALKWAY PADS

A. Adhere and heat weld walkway pads where shown on drawings or where required to provide protected pathways from rooftop access points to mechanical or other equipment requiring rooftop maintenance.

3.21 MEMBRANE PROTECTION

A. Walk Way Pads: Install manufacturer's walk way pads continuously on each side of each air-handling/mechanical unit on the roof in accordance with the manufacturer's recommended procedures.

B. Where equipment pads, wood sleepers, or walkway slabs are to be installed over the roofing membrane, an additional layer of the roofing membrane shall be installed between the roofing membrane and the pad, sleeper, or slab. Due caution shall be exercised to prevent roofing membrane damage during placement. Where required, membrane shall be welded to field membrane to prevent slippage.

3.22 CLEANING

A. Clean exposed surfaces of excess cement, adhesive, sealants, mortar and paint associated with the new work.

B. Clean work area of excess roofing materials and installation debris daily.

C. Repair or replace defaced or disfigured finishes caused by the work.

3.23 MEMBRANE CLEANING

A. After all membrane has been installed, it shall be cleaned with a cleaning agent compatible with the membrane to return the membrane to like new appearance.

3.24 PROTECTION

A. Protect all building surfaces against damage from roofing work.

B. Where traffic must continue over finished, installed roofing system, protect membrane, underlayment accessories and finishes from damage.

3.25 ROOF PLAQUE

A. Metal plaque shall be installed on the underside of each roof hatch or on the inside of the maintenance room door. Location of plaque to be determined by Project Manager/Architect.

B. Plaque shall be fastened with stainless steel screws to the wall surface as necessary at the base of the internal roof hatch ladder

3.26 ROOF HATCH

A. Refer to specification section 07 7200 Roof Accessories for further information

3.27 OVERNIGHT SEAL

A. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

B. Installation shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.

3.28 FIELD QUALITY CONTROL

A. Owner reserves the right to have finished Work inspected using infrared thermography or other appropriate, non-destructive means to establish satisfactory conditions of completed Work.

B. Correct identified defects or irregularities. Cut out and repair membrane defects before end of each day.

3.29 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services as required to qualify for specified warranty.

B. Roofing materials manufacturer's representative shall visit the site and observe the progress of the Work at a rate of not less than one time per week.

1. Site visits shall be followed up by a written report of findings which is to be transmitted to the Owner's Representative within five (5) days of the site visit.

3.30 PROTECTION OF FINISHED WORK

A. Protect finished Work under provision of application Section.

B. Where traffic must continue over finished roof installation, protect surfaces with minimum one-half inch (1/2") wood fiberboard insulation, under five-eighth inch (5/8") thick plywood protective walkways ballasted in place with sandbags or the like.

C. At all parapet and metal coping cap conditions, provide additional layer of self-adhered underlayment for temporary protection over all parapet and coping caps conditions once roofing has been completed and prior to installation of wood nailers and metal coping cap. Self-adhered underlayment is to cover cavity conditions from roof side of parapet framing to outside of exterior finish to protect cavity from moisture prior to completing parapet cap framing.

END OF SECTION

SECTION 07 62 00
SHEET METAL AND MISCELLANEOUS ACCESSORIES

PART 1 - GENERAL

1.01 AREAS COVERED

A. Refer to roof plans for areas to be included in the scope of work.

1.02 DEFINITIONS

ACM	Asbestos Containing Materials
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CTEM	Coal-Tar Elastomeric Membrane
EPA	Environmental Protection Agency
EPS	Expanded Polystyrene
EVT	Equiviscous Temperatures
FM	Factory Mutual
IBC	International Building Code
KEE	Ketone Ethylene Ester
NDL	No Dollar Limit
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety & Health Administration
SBS	Styrene-Butadiene-Styrene
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPRI	Single Ply Roofing Industry
UL	Underwriters Laboratories, Inc.

1.03 REFERENCES (INCLUDING LATEST REVISIONS)

A. Comply with governing local, state, and federal regulations, safety standards, and codes.

B. Testing Laboratory Services: Test results shall meet or exceed established standards.

C. Underwriters Laboratories, Inc. (Roofing Covering): Class A fire hazard classification.

D. American Society for Testing and Materials (ASTM)

E. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual

G. American Society of Civil Engineers – ASCE 7

1.04 INSTALLER QUALIFICATIONS

A. Roofing installer must be:
1. Currently prequalified with the Owner in accordance with Owner's prequalification requirements.
2. Currently in good standing with the manufacturer.
3. Installer must be an experienced single firm specializing in the type of roofing repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable as applicators by the Project Manager/Architect.
4. Contractor must have successfully completed previous projects warranted by the manufacturer.

B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

1.05 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer is one that is UL listed and has FM approvals for a membrane roofing system similar to that used for this project for a minimum of fifteen (15) years.

1.06 CONTRACT DOCUMENT QUALITY ASSURANCE

A. In the case of an inconsistency between the drawings and specifications or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Project Manager's/Architect's interpretation

1.07 SUBMITTALS

A. Product Data:
1. Submit shop drawings, product data and mockups of all sheet metal.

1.08 QUALITY ASSURANCE

A. Comply with governing local, state, and federal regulations, safety standards, and codes. Provide products of acceptable manufacturers in satisfactory use in similar service for five (5) years. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.

B. Reference Standards: Applicable portions of ASCE, SMACNA, ASTM, and NAAMM publications.

1.09 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference two weeks prior to commencing the Work.

B. Require attendance of parties directly affecting the Work of this Section.

C. Review condition of roof deck and installation, installation procedures and coordination with related work.

1.10 WARRANTIES

A. Manufacturer's Product Warranty: Submit manufacturer's standard limited product warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which the Owner/Project Consultant may have under the contract documents. Failure is defined to include product failure which leads to interruption of a watertight installation. Correction may include repair or replacement of failed product.

B. Contractor's Warranty Period: For roofing flashing and sheet metal, provide a written warranty which shall warrant work to be free of leaks and defects in materials and workmanship for two (2) years, starting from date of substantial completion.

C. Defects of the sheet metal occurring during the warranty period shall be promptly corrected by the contractor, and defects of the roofing shall be promptly corrected by the manufacturer at no additional cost to the Owner. Upon notification from the Owner or the Owner's representative that evidence of a defect exists, the responsible party shall immediately inform the Owner's representative of the date on which corrective work will be scheduled, and shall notify the Owner's representative when the corrective work has been completed.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIAL

A. Hot-dipped Galvanized Steel for use as counter flashings (where not visible from the ground), pitch pans and expansion joints: Minimum 24-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 653/A 653M.

B. Hot-dipped Galvanized Steel for use as continuous clips: Minimum 22-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 653/A 653M.

C. Prefinished Galvanized Sheet Steel (where visible from the ground): Shall be 24-gauge flat stock, prefinished with Kynar finish meeting ASTM A 446, forty-five and one-half inches to forty-eight inches width by one hundred twenty inches in length (45-1/2" - 48" x 120") for use as new metal edge gravel guard, cover plates, downspouts, gutters, coping and miscellaneous metal.

D. Stainless Steel: QQ-S-766, Class 304 or 316; or ASTM A 167, Type 304 or 316; form and condition most suitable for the purpose.

E. Prefinished Aluminum: Shall be that most suitable for the purpose.

F. All existing sheet metal shall be replaced with new metal of like gauge and type, or as specified on drawings.

G. All prefinished metal color shall be as selected by Owner/Architect from manufacturer's full range of colors, including metallics.

H. Elvaloy® Cladded Metal for Pitch Pans: Shall be G-90 galvanized steel with 25 mil Elvaloy® membrane.

I. Elvaloy® Cladded Metal: Shall be G-90 galvanized steel with 25 mil Elvaloy® membrane lamination; width shall be four feet (4'), length shall be eight feet (8') or ten feet (10').

2.02 FASTENERS

A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.

B. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide.

C. Fastener for Brick: Shall be one-fourth inch by two inches (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head.

D. Screws: Self-taping sheet metal type with neoprene washer, as appropriate.

E. Pop Rivets: Full stainless-steel Series 42 or 44, as appropriate.

F. Continuous Clip: Concealed hold-down clip type; of same materials as coping, gravel guard, sized to suit application. Use a continuous clip, minimum 22-gauge G-90 galvanized.

2.03 RELATED MATERIAL

A. Plastic Cement: FS SS-C-153, cutback asphalt type.

B. Solder: For use with galvanized steel or copper, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.

C. Copper, Sheet, and Strip: QQ-C-576, ASTM B 370, light cold-rolled temper, minimum 16 ounce.

D. Sealant (for Sheet Metal): One-component polyurethane, conforming to requirements of FS TT-S-230C, non-staining and non-bleeding.

E. Miscellaneous Materials:
1. Downspout Boots: Provide and install cast iron by Neenah Foundry Company, or pre-approved equal. Provide powder coating to match adjacent downspout color.
2. Splash Blocks: Concrete, 3000 psi, 28 days. Provide and install with protection pads at all downspouts. Dimensions shall be a minimum eighteen inches wide by thirty-six inches long (18" x 36").
3. Metal Accessories: Provide and install sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size, and gauge required for performance.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, substrates are smooth and clean and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure, prior to metal installation.

C. Beginning of installation means acceptance of conditions.

D. Compatibility: Provide materials that are recommended by manufacturers to be fully compatible with indicated substrates or provide separation materials as required to eliminate contact between incompatible materials.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work. Provide all shop drawings and mock-ups one month prior to installation to the Owner/Project Consultant for approval.

B. Install starter and edge strips and cleats before starting installation.

3.03 FABRICATION - GENERAL

A. Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer's instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

B. Form sheet metal on bending brake.

C. Form materials with straight lines, sharp angles and smooth curves.

D. Fold back edges on concealed side of exposed edge to form hem (1/4" minimum).

E. Weld or solder joints on parts that are to be permanently and rigidly assembled.

F. Limit single-piece lengths to ten feet (10').

G. Fabricate corner pieces with eighteen inch (18") extensions, mitered and sealed by forming as one piece.

H. Where installing flashing directly to masonry or dissimilar materials, backpaint with bituminous paint.

I. Install new metal rooftop projections. New rooftop projection details shall be as recommended in NRCA or SMACNA handbooks. All rooftop projections shall be cleaned, all joints sealed, and painted with a rust inhibitive paint.

J. All sheet metal shall be sealed and watertight.

K. Metal work should be secured so as to prevent damage from buckling or wind. Where clips are shown, fabricate as detailed.

L. All metal to receive bitumen or adhesive shall be first primed with asphalt primer.

M. All prefinished metal shall be sanded and/or abraded prior to receiving primer.

N. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

O. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.04 INSTALLATION

A. General: All sheet metal termination to vertical wall shall have a through-wall with receiver installed on masonry walls or prefabricated "Z" bar flashing pre-installed to fluid applied wall finished prior to installation of sheet metal termination. This applies to edge metal, base flashing closures and all vertical surface intersections. Refer to NRCA, SMACNA, and metal manufacturer's guidelines.

B. Gravel Guard/Fascia:
1. Shall be installed with expansion joints, ten feet (10') on center, one-fourth inch (1/4") expansion leeway, with a cover plate.
2. All gravel guard/fascia shall be pre-manufactured to meet ANSI/SPRI ES-1.
3. Form sections identical to profiles as shown or approved similar, to match existing building.
4. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
5. Hem exposed edges one-half inch (1/2") minimum.
6. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
7. Integrate flashing in a manner consistent with detailing.
8. Provide and install continuous clip, minimum 22 gauge.
9. Apply sealant at horizontal juncture of gravel guard metal to exterior vertical wall.
10. Shall be fabricated in accordance with published details.
11. Install bead of sealant at metal edge juncture at exterior wall surface.

C. Coping:
1. Install new pre-manufactured metal coping for a permanent watertight installation.
2. All coping shall be pre-manufactured to include low profile standing metal seam to meet ANSI/SPRI ES-1 requirements.
3. Shall be minimum 24-gauge prefinished Kynar installed in ten foot (10') sections maximum.

4. Vertical fascia shall extend minimum two and one-half inches (2-1/2") or be minimum one and one-half inches (1-1/2") below bottom of nailer, whichever is greater.
5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
6. Hem exposed edges one-fourth inch (1/4") minimum.
7. Provide and install continuous clip, minimum 22-gauge.
8. Shall be fabricated in accordance with published details.

D. Expansion Joint Field and at Wall:

1. Shall be as outlined by details and be in full compliance with these specifications.
2. Lock seams and end joints.
3. Fabricate corner pieces with minimum eighteen-inch (18"), maximum forty-eight-inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
4. Hem exposed edges one-fourth inch (1/4") minimum.
5. Back paint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
6. Integrate flashing in a manner consistent with detailing.
7. Provide and install continuous clip, minimum 22-gauge or one gauge thicker than flashing.
8. Shall be fabricated in accordance with published details.

E. Counterflashing:
1. Provide and install new two-piece sheet metal counterflashing as required for a permanent watertight installation.
2. Saw cut brick mortar joint to receive friction fit reglet and removable counterflashing as detailed in SMACNA 7th Edition Figure 4-4D.

F. Pitch Pans - Galvanized:
1. Install pitch pans of 24-gauge galvanized steel according to NRCA standards, minimum of six inches by six inches (6" x 6").
2. Pitch pans shall be fabricated to minimum of four inches (4") above the finished roof membrane. Seams of pitch pans shall be soldered.
3. Mastic shall be applied under pitch pan flange a minimum of one-half pound (1/2#) per linear foot.
4. All metal flanges shall be primed with asphalt primer prior to flashing installation. Inside of pitch pan shall be cleaned and primed as required by pitch pan sealant manufacturer.
5. All projections enclosed in pitch pans shall be cleaned in any manner suitable and coated with a rust inhibitive coating as approved by the Owner/Project Consultant. Coating shall be allowed to dry prior to pitch pan fill.
6. Base of pitch pans shall be filled around penetration with M-1 sealant. Sprinkle mod bit granules over sealant 1/4" deep.
7. Top finish fill shall be coal-tar urethane, with maximum fill to top of the pitch pan sides.
8. Strip metal flange of pitch pan with one strip of Type IV fiberglass felt set in hot bitumen extending from the outer edge of the flange a minimum of three inches (3") inward to base of pitch pan.
9. Strip in fiberglass felt with 60 mil coal-tar elastomeric membrane (CTEM) flashing set in hot asphalt extending from the outer edge of the Type IV fiberglass underlayment a minimum of three inches (3") inward to the base of the pitch pan.

G. Bonnets/Hoods:
1. Fabricate and install above all pitch pans, where necessary, or reinstall as applicable, metal bonnets over all pitch pans, NO EXCEPTIONS.
2. Bonnets/Hoods shall be manufactured with metal compatible with metal to which bonnet is to be attached.
3. On beams and other steel, weld in place bonnets fabricated from one-fourth inch (1/4") steel plate.
4. Draw band bonnets fabricated from 22-gauge galvanized steel may be used on circular projections.

3.05 FINISH

A. Backpaint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A 446 and AAMA specification 605.2 for high performance coating.

B. New 24-gauge hot-dipped galvanized metal shall be painted on all locations visible from the ground with an industrial grade paint as selected by Architect from manufacturer's full range of colors, including metallics. Galvanized metal surface must be properly prepared by removing all oil, grease, and/or protective mill coatings by solvent cleaning surface in accordance with SSPC-SP1, and according to paint manufacturer's recommendation, to ensure proper adhesion of paint to metal.

END OF SECTION

SECTION 07 62 13
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Precoated galvanized steel gutters, downspouts, scuppers, brackets, spacers, fasteners, stiffeners and caps.
   2. Prefinished stainless steel downspout boots.

1.02 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM A 48 – Grey Iron Castings.
   2. ASTM A 167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   3. ASTM A 361 – Sheet Steel, Zinc-Coated (Galvanized) by Hot-Dip Process for Roofing and Siding.
   4. ASTM A 446 – Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
   5. ASTM B 32 – Solder Metal.
   6. ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate.

B. Federal Specifications: FS TT-C-494 – Coating Compound, Bituminous, Solvent Type, Acid Resistant.

C. SMACNA – Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. Product Data: Provide technical data, installation instructions, and general recommendations for each specified sheet material and fabricated product.

B. Shop Drawings: Showing layout, profiles, jointing methods, fastening details, locations, and installation details.

C. Samples: Submit six inch (6") long samples of factory-fabricated products illustrating component design, finish, color and configuration.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Five years documented experience installing sheet metal systems.

B. Regulatory Requirements: Comply with applicable code for size and method or rainwater discharge. Comply with SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 5 years.

C. Gutters/Downspouts and all accessories shall be designed and provided by metal roofing manufacturer providing the standing seam metal roof panels.

1.05 DELIVERY, STORAGE AND HANDLING

A. Stack preformed and prefinished material to prevent twisting, bending or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate work with roofing work for correct sequencing of items which makes up entire weatherproof, rain drainage and sheet metal system.

B. Coordinate work with downspout discharge pipe inlet.

C. Coordinate gutter and downspout system with installation of field fabricated flashing and sheet metal and sheet metal roofing under Section 07600. Work of this Section shall bring gutters and downspouts to point of connection with roofing system, with necessary accommodations for connections.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pre-Coated Galvanized Steel: ASTM A 446, Grade A, G 90 zinc coating, 22-gauge core steel, shop pre-coated.

B. Fasteners: Galvanized steel screws, bolts or nuts, as applicable.

C. Stiffener Angles and Supports: Formed steel, type to match gutters, 18-gauge and clad with prefinished metal cover.

D. Solder: ASTM B 32, 50-50 percent tin/lead solder with rosin flux for use with steel.

E. Neutralized: Five percent (5%) to ten percent (10%) washing soda solution.

F. Protective Back Paint for Galvanizing: Zinc chromate or galvanized iron type.

G. Bituminous Coating: FS TT-G-494, or MIL-C-18480, or SSPC-12, cold-applied bituminous mastic, compound, for 15 mil dry film thickness coating.

H. Wire Screen: One-half inch (1/2") mesh, stainless steel.

I. Prefinished Stainless Steel Downspout Boots: Piedmont Model #SO, minimum 36 inch length with 6 inch x 6 inch inlet. Provide with tamper proof, removable clean out cover. Stainless steel powder coat factory finish color to match the downspout.

2.02 FABRICATION

A. Gutters: SMACNA style profile as detail by Architect; 22-gauge.

B. Downspouts: SMACNA profile as detailed by Architect; same gauge as gutter.

C. Fabricate gutters and downspouts true to design and dimensions, straight and without deformation. Finish work free from blemishes, abrasions, tool marks, burrs and other defects which may affect strength or performance. Form corners to smallest radius possible without causing grain separation or otherwise impairing work. Allow for expansion and contraction.

D. Completely weld joints in gutter sections to provide watertight units. Form expansion joints between gutter sections as shown. Weld stiffener angles to gutters 4'-0" on center.

E. Weld angles to underside of gutters at downspout locations to form frame, weld downspout tube to angles.

F. Form gutters in eight foot (8') or ten foot (10') long welded sections, lap joints one and one-half inch (1-1/2"). Provide loose-locked expansion joints midway between outlet tubes and where gutter ends adjoin walls. Fit joints with cover strips in manner to provide watertight connections.

G. Provide outlet tubes with flanges riveted and soldered to form gutters. Extend tubes three inches (3") into downspouts. Set gutters to slope to downspouts minimum one-eighth inch (1/8") for each foot.

H. Form downspouts in eight foot to ten foot (8' - 10') lengths. Telescope end joints one and one-half inch (1-1/2") and lock longitudinal joints. Fasten downspouts to walls with three inch (3") wide straps. Space straps not more than eight feet (8') apart. Provide shoulder of solder on each side of downspout above each strap. Fasten straps to walls with screws in lead sleeves. Form downspouts of length to discharge water three feet to zero inches (3' – 0") from building slab.

I. Lock and solder, or weld without flux all seams. Close tops of downspout heads with 18-gauge removable strainer type with wire screen.

J. Field measure site conditions prior to fabricating work.

K. Fabricate with required connection pieces.
L. Hem exposed edges of metal.

M. Support Brackets, shall be prefinished to match the gutter and 18 Ga, Joint Fasteners: Profiled to suit gutters and downspouts.

N. Anchorage Devices: SMACNA requirements. Type recommended by fabricator.

O. Downspout Supports – 18-gauge straps, Kynar: Color and Finish to match gutter.

P. Gutter straps and supports to be 18-gauge prefinished metal supports as detailed.

Q. Seal all metal joints watertight for full metal surface contact.

R. Downspouts: Rectangular profile. Seal all joints, six inches by six inches (6" x 6").

2.03 FINISHES

A. Gutter and Downspouts: 70-75 percent fluorocarbon resin equivalent to Kynar 500/Hylar 5000; custom color as selected by Architect.

B. Back paint concealed metal surfaces with protective backing paint to minimum dry thickness of 15 mils.

C. Apply bitumen protective backing paint on surfaces in contact with dissimilar materials.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install gutters, downspouts and accessories in accordance with SMACNA Architectural Sheet Metal Manual.

B. Joint lengths with seams watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters to drain.

D. Install downspout boots per manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

A. Flood test gutters and downspouts upon completion. Repair any leaks.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
1. Roof curbs
2. Equipment supports
3. Roof hatches
4. Wall Mounted Access Ladders
5. Roof supports

1.03 SUBMITTALS

A. Shop Drawings: Provide manufacturer's approved details of all pertinent conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.

B. Refer to Specification Section 01 33 00 for Submittal requirements
Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.04 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Factory Technical Representative: Roofing Contractor is to arrange and schedule the manufacturer's technical representative to be on site the first day of the installation of manufacturer's roofing system. The manufacturer's technical representative shall inspect the work of the contractor at least one time each week during the installation of the roofing system. The manufacturer's technical representative shall perform with the owner's representative and the roofing contractor a final inspection of the roofing system. At the completion of the final inspection, provide to the roofing contractor a list of punch list items (if any) to be correct before technical acceptance of the roofing project and prior to issuance of manufacturer's Twenty (20) Year Full System Warranty. Field reports shall be provided after each inspection within five (5) days of site visit.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
   1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes and roof expansion joints.

1.08 WARRANTY

A. The product manufacturer shall provide a one-year full system material warranty necessary to cover replacement of all components of the system against defects in manufacturing. The warranty will not include Acts of God, vandalism, neglect, metal finish or improper spacing of equipment, which would be a result of improper application.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.02 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.

C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.
   3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
      a) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:
         (1) Humidity Resistance: 1000 hours.
         (2) Salt-Spray Resistance: 1000 hours.

D. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and mill finish.
   1. Color: As selected by Architect
   2. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Acid-chromate-fluoride-phosphate conversion coating; Organic Coating: As specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
      a) Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mil, medium gloss.
      b) Color and Gloss: As selected by Project Manager from manufacturer's full range.
   3. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturer's written instructions.
      a) Color and Gloss: As selected by Project Manager from manufacturer's full range.
   4. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
      a) Color and Gloss: As selected by Project Manager from manufacturer's full range.

E. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.

F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

J. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.03 MISCELLANEOUS MATERIALS

A. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).

B. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of 12 to 16 ft-lbf/in. of width when tested according to ASTM D 256, Method A (Izod).

C. Cellulosic-FiberBoard Insulation: ASTM C 208, Type II, Grade 1, one inch (1") thick.

D. Glass-FiberBoard Insulation: ASTM C 726, one inch (1") thick.

E. Polyisocyanurate Board Insulation: ASTM C 1289, one inch (1") thick.

F. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than one and one-half inches (1-1/2") thick.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Polyethylene Sheet: 6-mil thick, polyethylene sheet complying with ASTM D 4397.

I. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   1. Slip Sheet: Rosin-sized paper, minimum 3 pounds per 100 square feet.

J. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

K. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

L. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

M. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

N. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.04 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Manufacturers:
      a) ThyCurb; Div. of Thybar Corporation.
      b) Uni-Curb, Inc.
      c) Vent Products Company, Inc.
   2. Load Requirements: Insert load requirements.
   3. Material: Galvanized steel sheet, 0.052 inch thick.
   4. Material: Aluminum sheet, 0.090 inch thick.
   5. Material: Stainless-steel sheet, 0.078 inch thick.
      a) Finish: Prime painted.
      b) Finish: Mill.
   6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   7. Factory install wood nailers at tops of curbs.
   8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   9. Factory insulate curbs with one and one-half inch (1-1/2") glass fiberboard insulation.
   10. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of fourteen inches (14"), unless otherwise indicated.
   11. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.05 EQUIPMENT SUPPORTS

A. To support HVAC Duct use Model # SS2000D Duct Support. SS2000D is two 17" circular bases with 12 ga. framing channel formed to make an “H” shaped support. Framing channel is adjustable in both height and width.
   1. Manufacturers:
      a). Advanced Support Products, Inc.

B. To support heavier HVAC equipment use equipment platform Model # HV0505B Base Platform designed by manufacturer to support the weight of the equipment and load requirements. Equipment platform shall consist of (a) 17" circular bases supporting a structural steel frame OR (b) galvanized steel plates, with four holes for approved anchoring per engineering data, supporting a structural steel frame.
   1. Manufacturers:
      a). Advanced Support Products, Inc.

2.06 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
   1. Manufacturers:
      Babcock-Davis; a Cierra Products Inc. Company.
      Bilco Company (The).
      Bristolite Skylights.
   2. Loads: Fabricate roof hatches to withstand 40 pounds per square foot external and 20 pounds per square foot internal loads.
   3. Type and Size: Single-leaf lid, thirty inches by thirty-six inches (30" x 36").
   4. Curb and Lid Material: Aluminum sheet, 0.090 inch thick.
      a) Finish: Baked enamel.
   5. Insulation: Cellulosic-fiberboard.
   6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
   7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
   8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   9. Fabricate units to minimum height of fourteen inches (14"), unless otherwise indicated.
   10. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height tapered to match slope to level tops of units.
   11. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
      a) Provide 2-point latch on covers larger than eighty-four inches (84").
   12. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
      a) Test Load: 500 lb.
      b) Height: Forty-two inches (42") above finished roof deck.
      c) Material and Finish: Aluminum, mill finished.
      d) Diameter: Pipe with one and five-eighths inch (1-5/8") OD tube.
   13. Hatch Lid to have and R value of R12

2.07 INTERIOR FIXED LADDER TO ROOF HATCH

A. Aluminum Fixed Vertical Ladder: Ladder, cage, rest platforms, floor mounting brackets, security doors, walk-thru, and side rails, as manufactured by Precision Ladders, or approved equal.
   1. The basis of design is FL Aluminum Fixed Vertical Ladder, as manufactured by Precision Ladders LLC.
   2. Capacity: Unit shall support a 1000 lb loading without failure.
   3. Performance Standard: Units designed and manufactured to meet or exceed ANSI A14.3 and OSHA 1910.27.

B. Components:
   1. Ladder Stringer: 2-1/2 inch by 1-1/16 inch by 1/8 inch extruded 6005-T5 aluminum channel. Pitch: 90 degrees.

2. Ladder Tread: 2-1/4 inch by 3/4 inch by 1/4 inch extruded 6005-T5 aluminum with deeply serrated top surface.
3. Ladder Mounting Bracket: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick aluminum angle.
4. Finishes:
   a) Mill finish on aluminum ladder components.

C. Fabrication
1. Completely fabricate ladder ready for installation before shipment to the site.
2. Completely fabricate handrail components ready for field assembly to ladder before shipment to site. Shall be premanufactured wall-mounted ladder of 0.125 by three inch (3") aluminum channel side rails with non-slip rungs as manufactured by Precision Ladders, LLC.., or approved equal.

B. Roof Access Ladder Warranty
1. Ladder manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, ladder manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   a) Defects in materials and workmanship.
   b) 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.
   c) Within the warranty period, the ladder manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

2. Ladder manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Ladder manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Ladder 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

2.08 ROOF PIPE SUPPORTS

A. To support conduit or pipe sized up to Ø8" when height adjustment is needed use Model # SS1000A Adjustable Pipe Support. 17" circular base with 12 ga. framing channel, 18"L, attached to 17" circular base using 1/2" threaded rods, 12"L, with washers and nuts. Height of channel can be adjusted along the length of the 1/2" threaded rods. Strut clamps are suggested to hold piping or conduit in place.
1. Manufacturers:
   a) Advanced Support Products, Inc.

B. To support water or gas piping up to Ø8" or when a roller support with height adjustment is needed use Model # SS1000RA Pipe Support with Adjustable Roller. 17" circular base with SBR heavy duty rubber roller assembly attached to 17" circular base using 1/2" threaded rods, 12"L, with washers and nuts. Height of roller assembly can be adjusted along the length of the 1/2" threaded rods.

1. Manufacturers:
   a) Advanced Support Products, Inc.

C. To support multiple pipe runs, piping up to Ø12" when height adjustment or pipe suspension is needed use Model # SS4000P, SS6000P or SS8000P Adjustable Support Bridge. SS4000P Adjustable Suport Bridge is made of four (4) 17" circular bases and 12ga. framing channel formed to make one “H” shaped support with crossbar. SS6000P Adjustable Suport Bridge is made of six (6) 17" circular bases and 12ga. framing channel formed to make two “H” shaped supports with crossbar. SS8000P Adjustable Suport Bridge is made of eight (8) 17" circular bases and 12ga. framing channel formed to make three “H” shaped supports with crossbar. Crossbar height is adjustable and offered in 18", 24", 36", and 48" lengths. Use Adjustable Support Bridge with strut clamps or roller accessories or use optional hanger supports to suspend water or gas piping at various heights. Optional hanger supports attached to support frame using 1/2" threaded rods. Hangers offer complete height adjustments along the length of 1/2" threaded rods.
   1. Manufacturers:
      a) Advanced Support Products, Inc.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

3.03 ROOF CURB INSTALLATION:

1. Set roof curb so top surface of roof curb is level.
2. Curb height to maintain a minimum of 10” above finished roof surface,
3. Attach roof curb according to manufacturer's written instructions

3.04 PIPE AND EQUIPMENT SUPPORT INSTALLATION:

1. Install support systems in accordance with manufacturer’s instructions and approved shop drawings.
2. Accurately locate and align pre-fabricated pipe supports in locations specified as per approved shop drawings or as required herein and by site conditions to limit pipe and/or conduit deflection to L/240, not to exceed 10' (3m) on center. No Isolation pads are required under the 17" circular bases.
3. Should the roofing manufacturer require a separation sheet between the roof and the support system, place a separation sheet or protective pad conforming to the existing roof manufacturer’s system under 17" circular bases. Do not adhere to the roof system or 17" circular bases.
4. If required, insert frame structures into 17" circular bases as indicated by manufacturer’s instructions.
5. Adjust height of each strut or channel and hanger or roller to its required height and tighten with nut, but do not over-tighten. Check each support for equal weight disbursement. Correct if necessary.
6. Remove any unused materials and packaging from job site. All gas lines, piping, and conduit must be supported on specified stands or hangars.
7. Supports shall be attached to pipes with oversized strapping.
8. Designated pipe/equipment supports shall be removed and replaced with new.
9. Verify that roof surface is smooth and clean to extent needed to receive materials. Surface shall be cleaned by removing any loose gravel and any foreign matter.
10. Install support systems in accordance with manufacturer's instructions and approved shop drawings. Accurately locate and align pre-fabricated pipe supports in locations specified as per approved shop drawings. Pipe supports shall be placed not to exceed ten feet (10') on center and within two feet (2") of all elevation changes, intersections, and corners.
11. Supports shall be set on a double layer of membrane, adhered to the roof surface using specified silyl-terminated polyester sealant, unless noted otherwise by support manufacturer.
12. Provide bond breaker between dissimilar metals.

3.05 ROOF HATCH INSTALLATION:

1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
2. Attach ladder safety post according to manufacturer's written instructions.
3. Provide the required structural members necessary to install the hatch into the roof deck. Refer to structural drawings for further information.

3.06 INSTALLATION OF INTERIOR FIXED LADDER TO ROOF HATCH

A. Examination:
   1. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
   2. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

B. Installation: Install in accordance with manufacturer's instructions.

C. Do not attach directly to the roof hatch assembly.

D. Protection:
   1. Protect installed products until completion of project.

3.07 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.08 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 8100
APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fireproofing of interior structural steel not exposed to damage or moisture.

B. Preparation of fireproofing for application of exposed finish specified elsewhere.

1.02 RELATED REQUIREMENTS

A. Section 01 1400 - Work Restrictions

B. Section 01 4533 - Code-Required Quality Control

C. Section 05 1200 - Structural Steel Framing.

D. Section 05 2100 - Steel Joist Framing.

E. Section 05 3100 - Steel Decking.

F. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).

C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

D. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

E. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

F. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.

G. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

B. Preinstallation Meeting: Convene two before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics, performance criteria, and limitations of use.

C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
   1. Bond strength.
   2. Bond impact.
   3. Compressive strength.
   4. Fire tests using substrate materials similar those on project.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Manufacturer Reports: Indicate environmental conditions that applied fireproofing materials were installed.

1.06 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 the type specified and with at least three years of documented experience
   1. Having minimum five years of documented experience.

1.07 MOCK-UP

A. Construct mock-up, 100 square feet in size.

B. Comply with project requirements for fire ratings, thickness, density of application, and code compliance.

C. Locate where directed.

D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity.

E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary; remove materials and re-construct mock-up.

F. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Applied Fireproofing:
   1. Carboline Company: www.carboline.com.
   2. GCP Applied Technologies: www.gcpat.com/fireproofing.
   3. Isolatek International Corp: www.isolatek.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES

A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   2. Dry Density: Minimum average density of 15 lb/cu ft, with minimum individual density of any test sample of 14 lb/cu ft, when tested in accordance with ASTM E605/E605M.
   3. Compressive Strength: 8.33 pounds per square inch, minimum.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
   6. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
   7. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   8. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759/E759M.

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fireproofing manufacturer.

B. Overcoat: As recommended by manufacturer of applied fireproofing material.

C. Metal Lath: Expanded metal lath; minimum 3.4 pounds per square foot, galvanized finish.

D. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.

B. Apply primer coating, fireproofing, and overcoat in accordance with manufacturer's instructions.

C. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

E. Apply overcoat at the rate recommended by fireproofing manufacturer.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

B. The owner will employ an independent agency to randomly sample and verify the thickness and the density of the fireproofing in accordance with the provisions of ASTM E605 and verify the bond strength of the fireproofing in accordance with ASTM E736.

C. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.

D. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

E. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 07 8123
INTUMESCENT FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thin-film intumescent mastic fireproofing.

B. Protective and/or decorative topcoats.

1.02 RELATED REQUIREMENTS

A. Section 01 1400 - Work Restrictions

B. Section 01 4533 - Code-Required Quality Control

C. Section 05 1200 - Structural Steel Framing.

D. Section 05 2100 - Steel Joist Framing.

E. Section 09 9000 - Painting and Coating: Field-applied paints matching intumescent fireproofing.

1.03 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 D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Performance characteristics and test results.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.

D. Verification Samples: For each thickness, color, sheen, and finish required, submit samples not less than 4 inch square on designated substrate illustrating finished appearance.

E. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.
   1. Extrapolation of member size and/or material thickness shown in the individual designs are not acceptable.

F. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.

G. Field Quality Control Submittals: Submit field test report.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified of similar size and scope and with at least five years of documented experience.

C. Mock-up
   1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship; approved mock-up will serve as a standard of comparison for subsequent work of this section.
   2. Finish at least 100 sq ft of surface in areas as designated by Architect.
   3. Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.
   4. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   5. Refinish mock-up area as required to produce acceptable work.
   6. Approved mock-up may remain as part of the project.

1.06 PRE-INSTALLATIONS CONFERENCE

A. Conduct pre-installation conferences at Project site prior to commencing work.

B. Attendees:
   1. Project Superintendent: presides over meeting and is responsible for minutes.
   2. Subcontractor (fireproofing)
   3. Manufacturer's technical representative
   4. Other directly affecting, or affected by work
   5. Testing agency
   6. Owner representative

C. Agenda:
   1. Access to work and conditions of proper installation
   2. Conditions of installation, such as substrates, existing and surrounding conditions, and environmental conditions,
   3. Conditions detrimental to installation
   4. Preparation procedures, including protection of adjacent work.
   5. Verify installer's receipt and understanding of installation instructions.
   6. Review submittals, installation procedures, and sequence.
   7. Review coordination with other work.
   8. Evaluate delivery schedule and construction progress schedule
   9. Observe sample installation
   10. Required protection procedures.
   11. Observe actual installation areas.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened containers with identification labels and testing agency markings intact and legible.

B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Store at temperatures not less than 50 degrees F in dry, protected area.
   2. Protect from freezing, and do not store in direct sunlight.
   3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.

C. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.

1. Provide temporary enclosures as required to control ambient conditions.
2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.
3. Maintain relative humidity between 40 and 60 percent in areas of application.
4. Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.

1.09 SEQUENCING

A. Sequence and coordinate application of intumescent coatings with related work specified in other Sections to comply with the following requirements:
   1. Coordinate installation of intumescent coatings with other items of work that may interfere with proper installation of coatings.
   2. Do not begin applying intumescent coatings until clips, hangers, supports, and other welded connections have been installed. Intumescent coatings manufacturer must approve in writing any clips, hangers, supports or connections that may installed over coating using mechanical or adhesive devices.
   3. Provide temporary enclosures as necessary to prevent deterioration of intumescent coatings due to exposure to unfavorable environmental conditions as required by installation procedures and product performance capabilities as supplied by manufacturer. Exposure to exterior elements for any portion of construction cycle must be supported a verified burn test to ensure no degradation of fire properties.
   4. Take appropriate steps to avoid abrasion and other damage to the applied intumescent coatings during construction operations.
   5. Do not protect or conceal structural members to which intumescent coatings have been applied until each area has been inspected, tested, and corrections have been made to any deficient areas.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Mastic Fireproofing:
   1. Albi Manufacturing Division of StanChem Inc: www.albi.com.
   2. Carboline Company: www.carboline.com.
   3. Hilti, Inc: www.us.hilti.com/steel-protection.
   4. Isolatek International Corp: www.isolatek.com/#s
   5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM REQUIREMENTS

A. Fireproofing: Provide intumescent thin-film fire resistive coating systems tested by an independent testing agency in accordance with full scale ASTM E119 and acceptable to authorities having jurisdiction (AHJ).
   1. Provide assemblies listed by UL, ULC, ITS/WH, or FMand bearing listing agency label or mark.

B. Structural Steel Columns: Fire resistance rating as noted on the drawings.

C. Structural Steel Beams: Fire resistance rating as noted on the drawings.

D. Structural Steel Beams and Exposed Steel Deck: Fire resistance rating as noted on the drawings.

E. Exposed Steel Deck: Fire resistance rating as noted on the drawings.

2.03 MATERIALS

A. Fire Resistive Coating System: Thin film intumescent mastic fireproofing system for fire protection of structural steel, concrete, concrete masonry units (CMU), and and other items as indicated on the drawings.
   1. Surface Burning Characteristics: Tested in accordance with ASTM E84.
      a. Flame Spread Index (FSI): 25, maximum.
      b. Smoke Developed Index (SDI): 50, maximum.
   2. For Interior Use:
      a. Use only water-based products.
      b. VOC Content: Less than 50 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
      c. Durometer Hardness, Type D: 39, minimum, in accordance with ASTM D2240.
   3. For Exterior Use:
      a. Use only solvent-based products.
      b. VOC Content: Less than 125 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
      c. Durometer Hardness, Type D: 39, minimum, in accordance with ASTM D2240.

2.04 AUXILIARY FIREPROOFING MATERIALS

A. General: Provide auxiliary fireproofing materials that are compatible with intumescent coating products and substrates and are approved by UL or other accredited testing agencies acceptable to authorities having jurisdiction for use in the fire resistive designs indicated.

B. Substrate Primers: For use on each different substrate, provide primer that complies with the following requirements:
   1. Primer approved in writing by manufacturer of intumescent coatings and applied in full compliance with the primer manufacturer’s recommendations.
   2. Primer to have been tested by manufacturer in fire conditions to ensure fire-performance of primer-intumescent system, and adhesion of the post-burn intumescent char to the primer. Documentation of such tests to be provided upon request.
   3. Primer must be fully cured prior to installation of the intumescent coating.

C. Topcoats: Suitable for application over applied intumescent coatings; of type recommended in writing by intumescent coatings manufacturer for each fire resistance design. Topcoat to have been tested by manufacturer for compatibility in fire conditions with documentation of such tests to be provided upon request. Color of topcoat shall be as selected by the architect. Colors shall not be limited to manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fireproofing; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Cover other work subject to damage from fall out or overspray of intumescent coatings materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintaining adequate ambient conditions for temperature and ventilation.

B. Thoroughly clean surfaces to receive fireproofing that could impair bond of fireproofing, including oil, grease, rolling compounds, incompatible primers, rust, and mill scale.

C. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.

D. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 APPLICATION

A. Coordinate application of intumescent coatings with other construction to allow for proper application and minimize need to repair damage.

B. Comply with manufacturer's instructions for particular conditions of installation applications.

C. Apply manufacturer’s recommended primer to required coating thickness. Prime substrates with an approved and compatible primer, unless an approved and compatible shop primer has been applied and is in satisfactory condition to receive intumescent coatings. Primer must be fully cured prior to applying intumescent coatings.

D. Apply fireproofing to full thickness over entire area of each substrate to be protected.

E. Apply coats at manufacturer’s recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition. Protect intumescent coatings from rain, direct sunlight, high humidity, strong wind (with dirt, dust or sand) during the application, drying, and curing phases, unless test evidence allows otherwise. Do not apply an additional coat of intumescent coating until previous layer has fully cured.

F. Apply intumescent fireproofing by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.

G. For applications visible upon 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 that would telegraph through fire resistive products after application.

H. Achieve uniform finished appearance complying with approved mock-up.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.
   1. Arrange for testing of installed intumescent mastic fireproofing by an independent testing laboratory using magnetic pull-off dry film thickness gage in accordance with SSPC-PA 2, and ensure it meets requirements of authorities having jurisdiction (AHJ).
   2. Submit field test reports promptly to Contractor and Architect.

B. Repair or replace intumescent mastic fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

3.05 CLEANING

A. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.06 PROTECTION

A. Protect installed intumescent mastic fireproofing from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not , and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 1400 - Work Restrictions

B. Section 01 4533 - Code-Required Quality Control

C. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

D. Section 09 2982 - Gypsum Board: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b, with Editorial Revision (2016).

D. ITS (DIR) - Directory of Listed Products; current edition.

E. FM 4991 - Approval Standard for Firestop Contractors; 2013.

F. FM (AG) - FM Approval Guide; current edition.

G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

H. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

I. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Certificate from authority having jurisdiction indicating approval of materials used.

G. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with ASTM E119 and ASTM E814.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
1. Approved by Factory Mutual Research Corporation under FM 4991

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
3. Everkem Diversified Products, Inc: www.everkemproducts.com/#sle.
4. Hilti, Inc: www.us.hilti.com/#sle.
5. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
6. Specified Technologies Inc: www.stifirestop.com/#sle.
7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

E. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

B. Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
   1. Hilti FS-ONE Intumescent Firestop Sealant
   2. Hilti CP 604 Self-Leveling Firestop Sealant
   3. Hilti CP 620 Fire Foam
   4. Hilti CP 606 Flexible Firestop Sealant
   5. Hilti CP 601s Elastomeric Firestop Sealant
   6. 3M Fire Stop Sealant 2000
   7. 3M Fire Barrier CP25 WB
   8. Tremco Tremstop Fyre-Sil Sealant

C. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
   1. Hilti CP 601s Elastomeric Firestop Sealant
   2. Hilti CP 606 Flexible Firestop Sealant
   3. Hilti FS-ONE Intumescent Firestop Sealant

D. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
   1. Hilti CFS-SP WB Firestop Joint Spray
   2. Hilti CP 601s Elastomeric Firestop Sealant
   3. Hilti CP 606 Flexible Firestop Sealant
   4. Hilti CP 604 Self-Leveling Firestop Sealant
   5. 3M Firestop Sealant 2000
   6. Tremco Tremstop Fyre-Sil Sealant

E. Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
   1. Hilti FS-ONE Intumescent Firestop Sealant
   2. 3M Fire Barrier CP25 WB
   3. Tremco Tremstop WBM Intumescent Firestop Sealant

F. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti FS-ONE Intumescent Firestop Sealant
   2. Hilti CP 618 Firestop Putty Stick
   3. 3M Fire Barrier CP25 WB
   4. Tremco Tremstop WBM Intumescent Firestop Sealant

G. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti FS-ONE Intumescent Firestop Sealant
   2. Hilti CP 618 Firestop Putty Stick
   3. 3M Fire Barrier CP25 WB
   4. Tremco Tremstop WBM Intumescent Firestop Sealant

H. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti CP 618 Firestop Putty Stick

I. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti CP 618 Firestop Putty Stick

J. Wall opening protective materials for use with UL listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
   1. Hilti CP 617 Firestop Putty Pad

K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
   1. Hilti CP 642 Firestop Collar
   2. Hilti CP 643 Firestop Collar
   3. Hilti CP 645 Firestop Wrap Strip
   4. 3M Fire Barrier PPD Plastic Pipe Device

L. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:
   1. Hilti CP 680 Cast-In Place Firestop Device
   2. Hilti CP 681 Tub Box Kit for use with tub installations

M. Materials used for large size/complex penetrations made to accommodate multiple steel and cooper pipes, electrical busways in raceways, the following products are acceptable:
   1. Hilti FS 635 Trowelable Firestop Compound
   2. Hilti FS 657 FIRE BLOCK
   3. Hilti CP 620 Fire Foam
   4. 3M Firestop Foam 2001
   5. 3M Fire Barrier CS-195 Composite Sheet

N. Cables passing through fire-rated floors or walls shall pass through fire-rated wiring devices which contain an intumescent insert material that adjusts automatically to cable additions or subtractions.
   1. Hilti FS 657 FIRE BLOCK
   2. Specified Technologies Inc., EZ-PATH Fire Rated Pathway

O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
   1. Hilti CP 672 Firestop Spray
   2. Hilti CP 601s Elastomeric Firestop Sealant
   3. Hilti CP 606 Flexible Firestop Sealant
   4. Hilti CP 604 Self-Leveling Firestop Sealant
   5. 3M Fire Barrier CP 25 WB

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-leveling pourable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 – Quality Requirements

B. Section 03 3000 – Cast-In-Place Concrete

C. Section 04 2000 – Unit Masonry

D. Section 07 6200 – Sheet Metal Flashing and Trim

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

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 C1193 - Standard Guide for Use of Joint Sealants; 2016.

F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015.

J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Executed warranty.

G. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
   1. All mastics, glues, and adhesives
   2. Sealant (interior use only)

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five (5) years of experience.

C. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.
   1. All joint sealants shall be field tested for proper adhesion to the joint substrates prior to installation. Do not proceed with the work until job site tests have been approved by the Architect.
   2. Locate and provide test joints for each type of joint sealant, and substrate as directed by the Architect.
   3. Acceptable test joints will be used as the standard for all joint sealant work on the project.
      a. Sealants which fail to adhere to the substrates shall be removed and replaced at no extra cost to the Owner.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Installer's Warranty: Correct defective work within a five (5) year period after Date of Substantial Completion.

C. Manufacturer Warranty:
   1. Silicone Exterior Joint Sealants: Twenty (20) years.
   2. Polyurethane Exterior Joint Sealants: Minimum five (5) years.
   3. All warranties shall include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
   1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Master Builders Solutions: www.master-builders-solutions.com
   4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
   5. Pecora Corporation: www.pecora.com/#sle.
   6. Sika Corporation: www.usa-sika.com/#sle.
   7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants:
   1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Master Builders Solutions: www.master-builders-solutions.com
   3. Pecora Corporation: www.pecora.com/#sle.

4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
      2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.
   c. Other joints indicated below.
3. Do not seal the following types of joints:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joint Sealant Schedule:
1. Joint Type EJS-1: Vertical joints in exterior walls: Silicone, non-sag, non-staining sealant, minimum of Class 50, unless otherwise indicated.
2. Joint Type EJS-2: Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
3. Joint Type EJS-3: Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
4. Joint Type EJS-4: Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joint Sealant Schedule: Use non-sag polyurethane sealant, unless otherwise indicated. Interior sealants shall be tamper resistant.
1. Joint Type IJS-1: Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joint Type IJS-2: Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Joint Type IJS-3: Floor Joints in Wet Areas: Non-sag polyurethane " -traffic-grade" sealant suitable for continuous liquid immersion.
4. Joint Type IJS-4: Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag tamper-resistant polyurethane sealant.

5. Joint Type IJS-5: Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
6. Joint Type IJS-6: In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
7. Joint Type IJS-7: Narrow Control Joints in Interior Concrete Slabs: Self-leveling polyurethane sealant.
8. Joint Type IJS-8: Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

2.03 SELF-LEVELING JOINT SEALANTS

A. Type IJS-7 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
4. Service Temperature Range: Minus 40 to 180 degrees F.

B. Type IJS-8 at horizontal expansion joint locations - Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Limestone.
4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.

C. Type EJS-4, IJS-8 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
4. Service Temperature Range: Minus 40 to 180 degrees F.

D. Type IJS-6 - High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0 Degrees C (32 Degrees F) meets requirements for low-temperature flexibility.
1. Color: White.

E. Type EJS-4 locations as applicable - Semi-Self-Leveling Polyurethane Sealant: Intended for expansion joints in sidewalks, swimming pool decks, plazas, floors and other horizontal surfaces with up to 6 percent slope.
1. Composition: Single or multicomponent.
2. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
3. Color: Match adjacent finished surfaces.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Horizontal: ASTM C1330; Type C - Closed Cell Polyethylene.
2. Vertical: ASTM C1330; Type B - Bi-Cellular Polyethylene.
3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

F. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
1. Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
1. Width/depth ratio of 2:1.
2. Neck dimension no greater than 1/3 of the joint width.
3. Surface bond area on each side not less than 75 percent of joint width.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 07 9513
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Placement of joint cover assembly frames in formwork.

B. Section 04 2000 - Unit Masonry: Placement of joint cover assembly frames in masonry.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, effected adjacent construction and anchorage locations.

D. Samples: Submit two samples six inch long, illustrating profile, dimension, color, and finish selected of each specified product.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

F. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
   1. All mastics, glues, and adhesives
   2. Thermal insulation (excluding fiberglass, foam, rubber)
   3. Fireproofing
   4. Sealant (interior use only)

G. Certificates - Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.06 QUALITY ASSURANCE

A. Materials and work shall conform to the latest edition of reference specifications specified herein and to all applicable codes and requirements of local authorities having jurisdiction.

B. Fire Performance Characteristics - Where indicated, provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or rated period by Underwriters Laboratories, Inc.
   1. Fire Rating - Not less than the rating of adjacent construction.

C. Loading Characteristics - Standard floor covers should be designed to withstand a maximum point load of 500 lbs. without damage or permanent deformation. Heavy-duty covers should withstand a point load of 2,000 lbs.

D. Single-Source Responsibility - Obtain expansion joint cover assemblies from one source from a single manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. Balco; a CSW Industrials Company: www.balcousa.com
   2. Construction Specialties, Inc: www.c-sgroup.com.
   3. EMSEAL Joint Systems, Ltd: www.emseal.com/#sle.
   4. Inpro: www.inprocorp.com/#sle.
   5. MM Systems Corp: www.mmsystemscorp.com.
   6. Nystrom, Inc: www.nystrom.com.
   7. Watson Bowman Acme Corp.: www.watsonbowmanacme.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Floor Joints at all types of Floor Finish :
   1. C-S Group; Model GFT-100 X 2 Floor to Floor Transition
   2. C-S Group; Model GFTW-100 X 2 Floor to Wall Transition
   3. C-S Group; Model PC-100 Floor to Floor Plate Cover

B. Floor Joints at all types of Floor Finish at existing concrete floor slab locations:
   1. C-S Group; Model GFPS-100 Floor to Floor Transition
   2. C-S Group; Model GFPSW-100 Floor to Wall Transition

C. Wall Joints at all types of Walls, Surface Mounted:
   1. C-S Group; Model ASM-100 Flat
   2. C-S Group; Model ASMC-100 Corner Transition

D. Ceiling Joints at Suspended Acoustic Ceiling Finish:
   1. C-S group; Model HC-100 Flat
   2. C-S Group; Model HCW-100 Wall to Ceiling Transition

E. Ceiling Joints at Gypsum Board Ceiling Finish:
   1. C-S Group; Model FWF-100 Flat
   2. C-S Group; Model FWFC-100 Wall to Ceiling Transition

F. Interior/Exterior Fire-Rated Wall Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. EMSEAL Joint Systems, Ltd; Emshield WFR2 System: www.emseal.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

G. Parking/Bridge Deck Joints:
   1. Manufacturers:
      a. EMSEAL Joint Systems, Ltd; Emshield DFR2 system: www.emseal.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.
   1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
   2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.

C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.

D. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.

E. Covers In Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.

F. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
   1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish Outdoors: Natural anodized.
   2. Exposed Finish at Floors: Mill finish or natural anodized.
   3. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
   1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
   2. Color: Floor: Gray Ceilings: White.

C. All joints specified for 1" wide. Wider joints, if indicated on the drawings, shall be same model series.

D. Anchors and Fasteners: As recommended by cover manufacturer.

E. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

F. Threaded Fasteners: Aluminum.

G. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

H. Provide manufacturers associated fire barrier at fire rated walls and floors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

C. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 PREPARATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.04 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

F. Accessories, including glazing, louvers, matching panels, and removable stops and astragals.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

C. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. 2012 TAS - Texas Accessibility Standards; 2012.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

F. ASTM A1008/A1008M - 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; 2018.

G. 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; 2017.

H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

L. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

M. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
   1. All mastics, glues, and adhesives
   2. Thermal insulation (excluding fiberglass, foam, rubber)
   3. Sealant (interior use only)
   4. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1, 2012 TAS and ADA Standards.
   3. Typical Door Face Sheets: Flush.
   4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
   a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

D. Doors at interior locations shall be manufactured of cold rolled, or annealed steel. Doors must be of continuously welded, seamless construction with all angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.

E. Doors at exterior locations shall be manufactured of A60 galvannealed or G60 hot dipped galvanized steel. Doors must be of continuously welded, seamless construction with all angles, molds, returns, and miters neatly welded and all weld beads ground smooth for finishing. All exterior doors shall seal tightly and not allow insect pests easy access to the buildings.

F. Face sheets of 16 gauge steel reinforced and sound-deadened by 22 gauge formed steel vertical stiffeners spaced not less than 6” o.c. and attached to face sheets by spot welds not less than 5” o.c. Vertical stiffeners at exterior door locations shall be galvannealed or hot dip galvanized. Voids between vertical stiffeners shall be filled with fiberglass batting.

G. Top and bottom edges closed with continuous recessed steel channels, of not less than 16 gauge, spot welded to both faces. Top edge of exterior doors sealed flush with welded in place closing channel to exclude water.

H. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.

I. Doors and frames are to be prepared to receive mortise type hardware and at hinge, lock, latch, and all other hardware locations, reinforcing plates shall be spot welded to the inner surface of the jambs. Hinge reinforcements shall not be less than 7 gauge steel. All top hinge reinforcements to incorporate manufacturer’s optional high frequency hinge reinforcement or full jamb depth hinge reinforcement. All other hardware reinforcements shall be not less than 12 gauge steel. Where door closers or brackets are to be installed, reinforcing plates shall be not less than 12 gauge steel. Twenty-four gauge galvanized steel plaster guards are to be spot welded over the hardware reinforcing plates. Provide 12 gauge reinforcement, for full height of door leaf, welded inside throat of frame to door rabbet wherever continuous geared hinges are scheduled. Provide 1/2” polystyrene, Celotex, or similar material, adhesive attached to the continuous hinge reinforcement inside the throat of the frame wherever continuous geared hinges are scheduled. Necessary holes for field installation of mortise type hardware shall be drilled and tapped from templates, which are to be furnished to the frame manufacturer by the hardware contractor. Provide suitable reinforcements for surface applied hardware, but no drilling or tapping is to be done at the factory for application of surface applied hardware. Prepare frames for silencers.

J. All glazing trim shall either be an integral part of the door face on the secure side with a removable bead flush with the opposite door face or metal glass light trim with a projection not to exceed 3/32” from either door face,

2.03 FULL AND TWO-LIGHT DOORS

A. Doors at interior locations shall be manufactured of cold rolled, or annealed steel. Doors must be of welded, seamless tubular stile and rail construction with all angles, tube intersections, molds, returns and miters neatly welded and all weld beads ground smooth for finishing. Visible seams on door faces are not acceptable.

B. Doors at exterior locations shall be manufactured of A60 galvannealed or G60 hot dipped galvanized steel. Doors must be of welded, seamless tubular stile and rail construction with all angles, tube intersections, molds, returns and miters neatly welded and all weld beads ground smooth for finishing. Visible seams on door faces are not acceptable.

C. Face sheets of 16 gauge steel. Voids in tubular members shall be filled with fiberglass batting.

D. Vertical stiles, top rail, and intermediate rail (if detailed) shall be of 6” nominal construction. Tubular construction of top rail shall provide a flush top surface to exclude water and moisture. Bottom rail shall be of 12” nominal construction.

2.04 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Core Material: Vertical steel stiffeners with fiberglass batts.
   2. Door Thermal Resistance: R-Value of 6 minimum.
   3. Door Thickness: 1-3/4 inch, nominal.
   4. Top Closures: Flush with top of faces and edges.
   5. Weatherstripping: Refer to Section 08 7100.

B. Interior Doors, Non-Fire Rated:
   1. Door Core Material: Vertical steel stiffeners.
   2. Door Thickness: 1-3/4 inch, nominal.

C. Fire-Rated Doors:
   1. Fire Rating: As indicated on drawings, tested in accordance with UL 10C ("positive pressure").
      a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
      b. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
      c. Attach fire rating label to each fire rated unit.
   2. Core Material: Vertical steel stiffeners.
   3. Door Thickness: 1-3/4 inch, nominal.

2.05 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   3. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.
   4. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 14 gage, 0.067 inch or 16 gage, 0.053 inch, minimum.
   2. Three-sided frames for single doors up to and including 4’-0” in width shall be manufactured of 16 gauge steel. Frames for pairs of doors 6’-0” and over, all sidelight frames, and all borrowed light frames shall be manufactured of 14 gauge steel. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 14 gage, 0.067 inch or 16 gage, 0.053 inch, minimum.
   3. Three-sided frames for single doors up to and including 4'-0" in width shall be manufactured of 16 gauge steel. Frames for pairs of doors 6'-0" and over, all sidelight frames, and all borrowed light frames shall be manufactured of 14 gauge steel. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.

E. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
   1. All two-piece mullions shall be factory welded to form a single-piece, inseparable section before assembly into a frame unit.

F. Transom Bars: Fixed, of profile same as jamb and head.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.07 ACCESSORIES

A. Louvers: Roll formed steel with concealed frame; finish same as door components ; factory-installed.
   1. Style: Standard straight slat blade.
   2. Fasteners: Exposed tamper proof fasteners.

B. Glazing: As specified in Section 08 8000.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered corners; prepared for countersink style tamper proof screws.

D. Astragals for Double Doors: Specified in Section 08 7100.

E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

F. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

G. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions. Omit silencers on exterior doors.

H. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

I. For each jamb in masonry construction, provide 3 or more 16 gauge adjustable jamb anchors of the T-anchor type or of the wire masonry anchor type spaced not more than 30" apart.

J. For each jamb in steel stud construction, provide 3 or more 18 gauge drywall type jamb anchors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

D. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

E. Verify exterior substrates and weather barriers have been completed to ensure proper air/water tight transition is maintained.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Where practicable, place frames prior to construction of enclosing walls and ceilings.

D. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set.

E. Coordinate frame anchor placement with wall construction.

F. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

G. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

H. At in-place construction, set frames and secure to adjacent construction with machine screws and suitable anchorage devices. Provide “Z” fillers at each screw location.

I. Fit and hang doors to maintain specified clearances. Metal hinge shims are acceptable to maintain clearances.

J. Install door hardware as specified in Section 08 7100.

K. Comply with glazing installation requirements of Section 08 8000.

L. Coordinate installation of electrical connections to electrical hardware items.

M. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touch-up of compatible air-drying primer.

N. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

B. Wood veneer facing, factory finished with transparent finish.

1.02 RELATED REQUIREMENTS

A. Section 01 6210 - Schedule of Materials and Colors

B. Section 08 1113 - Hollow Metal Doors and Frames.

C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

B. ASTM E413 - Classification for Rating Sound Insulation; 2016.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 6 by 6 inches in size illustrating wood grain, stain color, and sheen.

E. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Specimen warranty.

H. Warranty, executed in Owner's name.

I. Closeout Submittals
   1. Submit under provisions of Section 01 7800 – Closeout Submittals.
   2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
      a. All mastics, glues, and adhesives
      b. Sealant (interior use only)
      c. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.
   1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

D. Certifications
   1. Fire Ratings Compliance: Fire-rated wood doors to comply with NFPA-80, Positive Pressure Testing UBC 7-2-97 and/or UL10C, and requirements according to building code standards having local jurisdiction.
   2. Label Certification: All doors requiring fire-rating shall carry either UL or ITS (Warnock Hersey) metal label stating:
      a. Name and Logo of Listing Agency
      b. Name of Door Manufacturer
      c. Compliance with UBC 7-2-97 and/or UL10C
      d. Temperature rise rating
      e. Compliance with “S” label and/or UL 1784 requirements at all 20-minute rated doors and elsewhere as required by the building code and/or the AHJ
      f. Hourly rating

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect doors from dirt, water and abuse.

C. Accept doors on site in manufacturer's packaging, and inspect for damage.

D. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

E. Do not subject interior doors to extremes in either heat or humidity. HVAC systems should be operational and balanced, providing a temperature range of 50 to 90 degrees Fahrenheit and 30% to 50% relative humidity.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction, and repair or replacement of the door as originally furnished.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com.
   2. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
   3. Oregon Door: www.oregondoor.com/#sle.
   4. VT Industries, Inc: www.vtindustries.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
2. Wood Veneer Faced Doors: 5-ply, Grade A unless otherwise indicated.
3. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at each location.
2. Fire Rated Doors: Tested to ratings as indicated on drawings in accordance with ICC (IBC) - Positive Pressure; Underwriters Laboratories Inc. (UL) labeled.
3. Sound Retardant Doors: Minimum STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
4. Wood veneer facing with factory applied finish as scheduled in Section 01 6210 and where indicated on drawings.
5. High pressure decorative laminate (HPDL) finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, or fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Species as scheduled in Section 01 6210, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
1. Vertical Edges: Same species as face veneer.
2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
1. Provide solid blocks at Lock edge, top of door for closer, and exit devices for hardware reinforcement.
2. Provide solid blocking for other throughbolted hardware.
3. Mineral core veneer doors should have a minimum of 1/2” stile on hinge edge of door. Veneer shall be 5 ply.

C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Cut and configure exterior door edge to receive recessed weatherstripping devices.

G. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. See Section 01 6210 Schedule of Materials and Colors and Section 09 9000 Paintings and Coatings.

B. Finish doors in accordance with approved sample. Door color and finish shall be coordinated with the casework color and finish and approved by the Architect prior to fabrication.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 1113.

B. Aluminum Frames: As specified in Section 08 1116 - Aluminum Doors and Frames.

C. Metal Louvers:
   1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.

D. Glazing: See Section 08 8000.

E. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

F. Astragals for Fire-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 and ITS (DIR) requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. Install door louvers plumb and level.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements, rough-in dimensions, and operation features.

E. Project Record Documents: Record actual locations of each access unit.

F. Closeout Submittals
   1. Submit under provisions of Section 01 7800 – Closeout Submittals.
   2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
      a. All mastics, glues and adhesives
      b. Sealant (interior use only)
      c. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:
   1. Material: Steel.
   2. Size: 24 by 24 inch, unless otherwise indicated.
      a. 10 x 10 inches at single valve access and at all roof drain locations on first floor.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
   5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   6. Plaster Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

B. Wall-Mounted Units in Wet Areas:
   1. Material: Stainless steel.
   2. Size: 24 by 24 inch, unless otherwise indicated.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
   5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   6. Plaster Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

C. Fire-Rated Wall-Mounted Units:
   1. Wall Fire-Rating: As indicated on drawings.
   2. Material: Steel.
   3. Size: 24 by 24 inch, unless otherwise indicated.
   4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceiling-Mounted Units:
   1. Material: Steel.
   2. Size in Other Ceilings: 24 by 24 inch, unless otherwise indicated.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

E. Fire-Rated Ceiling-Mounted Units:
   1. Ceiling Fire-Rating: As indicated on drawings.
   2. Material: Steel.
   3. Size: 24 by 24 inch, unless otherwise indicated.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated coiling doors.

B. Electric operators and control stations.

C. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

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. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

F. NEMA MG 1 - Motors and Generators; 2018.

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.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, 3 by 6 inches in size illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the 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 documented experience and approved by manufacturer.

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace doors that fail in materials or workmanship within the specified warranty period.
   1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. C.H.I. Overhead Doors: www.chiohd.com/#sle.
   2. Clopay Building Products: www.clopaydoor.com/#sle.
   3. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
   4. Raynor Garage Doors: www.raynor.com/#sle.
   5. The Cookson Company: www.cooksondoor.com/#sle.
   6. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com/#sle.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

A. Insulated Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative design wind loads of 20 psf, without undue deflection or damage to components.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.0.
   3. Air Infiltration – Maximum air leakage of 1.00 cfm/ft^2 in accordance with the ICC (IECC) International Energy Conservation Code.
   4. Nominal Slat Size: 3 inches wide by required length.
   5. Finish: Factory powder coated, color as selected. See Section 01 6210-Schedule of Materials and Colors.
   6. Guide, Angles: Powder coated to match curtain.
   7. Hood Enclosure: Manufacturer's standard; Powder coated to match curtain.
      a. Provide mechanism cover for all exposed moving operator components.
   8. Electric operation.
   9. Mounting: Surface mounted.

2.03 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom for Slat Curtains: Fitted with angles or aluminum extrusions to provide reinforcement and positive contact in closed position.
   3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and lintel brush seal where curtain enters hood enclosure of exterior doors.
   4. Steel Slats: Minimum thickness, 22 gauge, 0.03 inch; ASTM A653/A653M galvanized steel sheet. Provide 20 gauge slats where opening size dictates.
      a. Galvanizing: Minimum G60 coating.

B. Guides - Angle: ASTM A36/A36M metal angles, size as required for door configuration.

C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

1. Minimum thickness; 24 gauge, 0.024 inch.
2. Powder coated to match curtain.
3. Provide mechanism cover for all exposed moving operator components.

D. Lock Hardware:
1. Locking Mechanism with interchangeable core: Latchset lock cylinder, specified in Section 08 7100.

E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
1. Provide tamperproof operation cycle counter.

B. Electric Operators:
1. Mounting: Front of Coil.
2. Motor Enclosure:
a. Interior Coil: NEMA MG 1, Type 1; totally enclosed fan cooled (TEFC).
3. Motor Rating: Minimum 1/3 HP; industrial duty, or as required by the manufacturer.
4. Motor Voltage: 120 volts, single phase, 60 Hz. minimum. Verify with electrical drawings.
5. Controller Enclosure: NEMA 250, Type 1.
6. Opening Speed: 8-9 inches per second.
7. Brake: Manufacturer's standard type, activated by motor controller.
8. Manual override in case of power failure.
9. See Division 26 - Electrical for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard “Open/Close” key-operated, 'Open-Close-Stop' momentary-contact control device with interchangeable core, NEMA 1B for each operator complying with UL 325.
1. 24 volt circuit.
2. Surface mounted, at interior door jamb at CMU walls.
3. Recess mounted, at interior door jamb at gypsum walls.
4. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
a. Primary Device: Provide monitored sensing edge with wireless edge connection to motor control circuit for momentary contact open/close control.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Division 26 Electrical.

F. Complete wiring from disconnect to unit components.

G. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3473
SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound control door assemblies.
   1. Metal doors and frames.
   2. Fire-rated doors and frames.
   3. Interior doors and frames, non-fire-rated.

B. Accessories, including glazing and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. BHMA: Builders Hardware Manufacturers Association.

D. HMMA: Hollow Metal Manufacturers Association.

E. NAAMM: National Association of Architectural Metal Manufacturers.

F. NFPA: National Fire Protection Association.

G. SDI: Steel Door Institute.

H. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

H. ASTM A1008/A1008M - 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; 2018.

I. 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; 2017.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

K. ASTM E413 - Classification for Rating Sound Insulation; 2016.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. ITS (DIR) - Directory of Listed Products; current edition.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

Q. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

R. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames; 2013.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

U. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

V. SDI 128 - Guidelines for Acoustical Performance of Standard Steel Doors and Frames; 2016.

W. UL (DIR) - Online Certifications Directory; Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect metal doors in compliance with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) and specified requirements.

1. Temporary Frame Spreaders: Provide welded frame jamb spreaders to bottom of metal frame prior to shipping.

B. Protect wood doors in compliance with WDMA I.S. 1A and specified requirements.

C. Remove doors and frames from resilient packaging upon delivery on site and inspect for damage, provide cover over doors for protection until installed, and store in vertical position properly braced with blocking to permit air circulation between components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Sound Control Door Assemblies:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Industrial Acoustics Co, Inc (IAC): www.iac-acoustics.com
   4. Krieger Specialty Products: www.kriegerproducts.com
   5. Overly Door Company: www.overly.com/#sle.
   6. Wenger Corporation: www.wengercorp.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Opening Force of Sound Control Doors, Non-Fire Rated: 5 lbs, maximum, in compliance with ADA Standards.

C. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with specified requirements for each type; for instance, a sound control door is also indicated as being an exterior door must comply with requirements specified for sound control doors and exterior doors; where two requirements conflict, comply with most stringent.

2.03 COMPONENTS

A. Panels: Same construction, performance, and finish as doors.

B. Metal Door Top Closures: Flush end closure channel, with top and door faces aligned.

C. Door Edge Profile: Manufacturer's standard for application indicated.

D. Glazed Lights: Factory installed, with removable stops on secure side; sizes and configurations as indicated on drawings.
   1. Style: Manufacturer's standard.

2.04 SOUND CONTROL DOORS

A. Metal Sound Control Interior Doors: Provide fire-rated door construction as indicated.
   1. Metal Doors: Refer to drawings for locations and additional requirements.
      a. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
         1) Level 1 - Standard-duty.
         2) Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
         3) Model 1 - Full Flush.
         4) Comply with guidelines of SDI 128 for acoustic performance of metal doors and frames.
         5) Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.

b. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   1) Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      (a) Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) where necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

2. Sound Transmission Class (STC) Rating of Sound Control Door Assembly: STC of 50, minimum, tested in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Thickness: As required to comply with sound control requirements as indicated.
4. Door Face Sheets: Flush.
5. Door Finish: Factory primed and field finished.
6. Sound Seals: As required by manufacturer to meet indicated sound control ratings.
7. Interior Doors, Non-Fire Rated:
   a. Door Core Material: As required by manufacturer to meet indicated sound control ratings.
8. Fire-Rated Doors:
   a. Fire Rating: As indicated on drawings, complying with NFPA 80 and tested in accordance with UL 10C and NFPA 252 as positive pressure fire tests.
   b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      1) Attach fire rating label to each fire rated unit.
   c. Door Core Material: As required by manufacturer to meet indicated fire and sound control ratings.

2.05 SOUND CONTROL DOOR FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Metal Sound Control Interior Door Frames: Face welded type.
   1. Frame Finish: Factory primed and field finished.
   2. Interior Door Frames, Non-Fire Rated:
      a. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
   3. Fire-Rated Door Frames:
      a. Fire Rating: Same as door, and labeled.
      b. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

C. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.

D. Transom Bars: Fixed, of profile same as jamb and head.

E. Provide mortar guard boxes for hardware cut-outs in frames installed in masonry or being grouted.

F. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

G. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.06 DOOR HARDWARE

A. Astragals for Double Doors: Overlapping or meeting stile for field installation in compliance with sound control requirements.
   1. Fire-Rated Doors: Steel, and shape as required for fire rating.

B. Hinges: Cam lift type by door manufacturer, coordinate with Section 08 7100.

C. Threshold: Provide sound control/acoustic seal for sill of door in closed position by door manufacturer.

D. Sound Control Seals: Provide sound control/acoustic seals for jambs and head of door in closed position by door manufacturer.

2.07 FINISHES

A. Primer, Metal Doors and Frames: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard, in compliance with local VOC requirements.

B. Metal Door and Frame Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
   1. Color: As scheduled.

C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.08 ACCESSORIES

A. Glazing: Laminated heat strengthened annealed glass, 1/2 inch (12.7 mm) overall thickness, factory installed, and tested to comply with specified sound control and fire ratings as indicated.

B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

C. Grout for Frames: Portland cement grout with maximum of 4 inch slump for hand troweling; thinner pumpable grout of higher slump is not permitted.
   1. Grouting of frames in drywall/gypsum board construction is not permitted.
   2. Frame to be packed with 10 pound density mineral wool.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 865.

F. Factory installed glazing, comply with installation requirements; see Section 08 8000.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 865.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced sound control door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Adjust sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 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 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

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; 2014.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

K. ASTM 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; 2004 (Reapproved 2012).

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

N. 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.

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting two weeks before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.

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.
   1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

E. Samples: Accompanying the Shop Drawings, submit:
   1. Sample of each exposed member.
   2. Samples of finish, showing complete range of color from darkest to lightest proposed for use on this Work.
   3. Samples, when approved by the Architect, will be used to verify that the installed finish is within the approved range.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations stamped and signed by a Structural Engineer licensed in the State of Texas.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Texas.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 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.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (EXTERIOR)

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer Company Inc; Trifab VG 451T Storefront System.
   2. Basis of Design: Kawneer Company Inc; Trifab 601T Storefront System.
   3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   4. Vertical Mullion Dimensions: 2 inches wide by 6 inches deep.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. Arcadia, Inc.: www.arcadiainc.com
   2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
   3. Columbia Commercial Building Products: ccbpwin.com.
   4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
   5. EFCO, a Pella Company: www.efcocorp.com/sle.
   6. Kawneer Company, Inc.: www.kawneer.com.
   7. Manko Window Systems, Inc.: www.mankowindows.com.
   8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
   9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
   10. Tubelite, Inc.: www.tubeliteinc.com
   11. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (INTERIOR)

A. Center-Set Style:
   1. Basis of Design: Kawneer Company Inc; Trifab VG 451 Storefront System.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. Arcadia, Inc.: www.arcadiainc.com
   2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
   3. Columbia Commercial Building Products: ccbpwin.com.
   4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
   5. EFCO, a Pella Company: www.efcocorp.com/sle.
   6. Kawneer Company, Inc.: www.kawneer.com.
   7. Manko Window Systems, Inc.: www.mankowindows.com.
   8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
   9. Trulite Glass and Aluminum Solutions, LLC: www.trulite.com.
   10. Tubelite, Inc.: www.tubeliteinc.com
   11. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Not Thermally-Broken:
   1. Basis of Design: Kawneer Company Inc; 500 Heavy Wall Entrance Door.
   2. Thickness: 2 inches.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:

1. Arcadia, Inc.: www.arcadiainc.com
2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
3. Columbia Commercial Building Products: ccbpwin.com.
4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
5. EFCO, a Pella Company: www.efcocorp.com/sle.
6. Kawneer Company, Inc.: www.kawneer.com.
7. Manko Window Systems, Inc.: www.mankowindows.com.
8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
10. Tubelite, Inc.: www.tubeliteinc.com
11. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.04 STOREFRONT

A. Aluminum-Framed Storefront: 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 all surfaces that will be exposed in completed assemblies.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; 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.
   5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
   9. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Performance Requirements:
   1. General Requirements
      a. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
      b. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
      c. Provide concealed fastening.
      d. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
      e. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.

f. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
g. Provide for expansion and contraction without detriment to appearance or performance.
h. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
i. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
j. Coordinate all door hardware with Section 08 7100 – Door Hardware.

2. Frame calculations shall be designed by a registered engineer in the State of Texas. Manufacturer is responsible for system reinforcing.
3. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.
   b. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
4. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
5. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
6. Thermal Requirements:
   a. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180º F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
   b. Ensure doors function normally within limits of specified temperature range.
   c. Thermal Break with a 1/4" separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
   4. High Performance Sub Sill.

B. Aluminum Subframing and Subsills: Extruded aluminum, thermally broken to match framing members where required, integrate with framing member drainage system.
   1. Finish: Same as storefront.
   2. Subframing: At perimeter of units, where indicated.
   3. Flat Fillers: At head and jambs of exterior units where no subframing is indicated.
   4. Sub-sills: At high-performance sills at exterior units.

C. Glazing: As specified in Section 08 8000.

D. Swing Doors: Glazed aluminum.
   1. Thickness: 2 inches. with .188 inch wall thickness
   2. Top Rail: 5 inches wide. Provide manufacturer’s closure plate as required to accept door closure.
   3. Vertical Stiles: 5 inches wide.

4. Mid Rail: 8 1/4 inches wide.
5. Bottom Rail: 10 inches wide.
6. Glazing Stops: Square.
7. Finish: Same as storefront.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Internal Reinforcing:
1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
2. Shapes and sizes to suit installation.
3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

E. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.

F. Fasteners:
1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.
2. Do not use exposed fasteners, except where unavoidable for application of hardware.
3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
4. For concealed locations, provide manufacturer's standard fasteners.
5. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.

G. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

H. Glazing Reducer:
1. 451-VG-029 Snap-in 1/4" infill adapter or equal by the frame manufacturer for storefront located at interior locations.

I. Glazing Gaskets:
1. Compression type design, replaceable, molded or extruded, of neoprene, or ethylene propylene diene monomer (EPDM).
2. Conform to ASTM C509 or C864.
3. Profile and hardness as required to maintain uniform pressure for watertight seal.
4. Provide in manufacturer's standard black color.

J. Weatherstripping:
1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

K. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.

L. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.

M. Glazing Accessories: As specified in Section 08 8000.

N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.07 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.08 FABRICATION

A. Coordination of Fabrication:
1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

B. General:
1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements and for support to structure.
3. Comply with Section 08 8000 for glazing requirements.

C. Aluminum Framing:
1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
2. Fabricate frame assemblies with joints straight and tight fitting.
3. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
4. Seal horizontals and direct moisture accumulation to exterior.
5. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
6. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
7. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer.
8. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.
9. Provide thermally broken aluminum backer plate at perimeter of all windows and individual sealed aluminum caps at the top of all vertical window frame mullions.
10. Provide fully soldered/sealed end dams at ends of subsill system.

D. Entrance Doors:
1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
2. Provide extruded aluminum glazing stops of square design, permanently anchored on security side and removable on opposite side.

E. Welding:
1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

F. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.09 HARDWARE

A. Receive hardware supplied in accordance with Section 08 7100 – Door Hardware and install in accordance with requirements of this Section.

B. Cut, reinforce, drill and tap frames and doors as required to receive hardware.

C. Comply with hardware manufacturer's templates and instructions.

D. Use concealed fasteners wherever possible.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Verify exterior substrates and weather barriers have been completed to ensure proper air/water tight transition is maintained.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

F. Provide thermal isolation where components penetrate or disrupt building insulation.

G. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install operating sash.

K. Set thresholds in bed of sealant and secure.

L. Install hardware using templates provided.

M. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.

N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general testing and inspection requirements.

B. Air/Water Leakage Testing: Provide chamber test per ASTM E1105 at 10% of glazing area per building, to be performed at mockup, 35% and 50% completion.
   1. Testing to be performed at 0.67 times the ASTM E331 rated pressure provided by the manufacturer for the system, not less than 5.6 psf.

C. Water-Spray Test: Provide water spray quality test of installed storefront 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.

3.05 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

B. Adjust operating hardware for smooth operation.

3.06 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, and take care to remove dirt from corners and to wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestop at system junction with structure.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.

C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

K. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.

L. ASTM 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; 2004 (Reapproved 2012).

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

O. 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.

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 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.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for 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. Samples: Accompanying the Shop Drawings, submit:
   1. Sample of each exposed member.
   2. Samples of finish, showing complete range of color from darkest to lightest proposed for use on this Work.
   3. Samples, when approved by the Architect, will be used to verify that the installed finish is within the approved range.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

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. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. 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 Texas.

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 type specified and with at least five years of documented experience.

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Pressure Cap Four Sides; Not Unitized, Field Assembled:
   1. Basis of Design: Kawneer Company Inc; 1600 Curtain Wall System.

B. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below.
   1. Arcadia, Inc.: www.arcadiainc.com
   2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
   3. Columbia Commercial Building Products: ccbpwin.com
   4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com.
   5. EFCO, a Pella Company: www.efcocorp.com/sle.
   6. Kawneer Company, Inc.: www.kawneer.com
   7. Manko Window Systems, Inc.: www.mankowindows.com
   8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
   9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
   10. Tubelite, Inc.: www.tubeliteinc.com
   11. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN - SWINGING DOORS

A. Wide Stile, Insulating Glazing, Not Thermally-Broken:
   1. Basis of Design: Kawneer Company Inc; 500 Heavy Wall Entrance Door.
   2. Thickness: 2 inches.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. Arcadia, Inc.: www.arcadiainc.com
   2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
   3. Columbia Commercial Building Products: ccbpwin.com
   4. C.R. Laurence Co., Inc; U.S. Aluminum: www.crl-arch.com.
   5. EFCO, a Pella Company: www.efcocorp.com.
   6. Kawneer Company, Inc.: www.kawneer.com
   7. Manko Window Systems, Inc.: www.mankowindows.com
   8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
   9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
   10. Tubelite, Inc.: www.tubeliteinc.com
   11. YKK AP America Inc.: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Fabrication Method: Either shop/factory or field fabricated system.
   2. Glazing Method: Either shop/factory or field glazed system.

3. Mullion Dimensions: 2-1/2 inches by depth as required by engineered drawings for structural performance.
4. 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.
5. 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.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. 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.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

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 requirements of ASCE 7.
      a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
      b. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.
      c. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
   2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F 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: 12 psf.
   2. Test Method: AAMA 501.1.

D. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.24 psf pressure differential across assembly.

E. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 71, minimum, measured in accordance with AAMA 1503.
   2. Overall U-value Including Glazing: 0.46 Btu/(hr sq ft deg F), maximum.

2.04 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.

B. Glazing: As specified in Section 08 8000.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

C. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

E. Firestopping: As specified in Section 07 8400.

F. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: As specified in Section 08 8000.

J. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

K. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.07 FABRICATION

A. Coordination of Fabrication:
1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

B. General:
1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements and for support to structure.
3. Comply with Section 08 8000 for glazing requirements.

C. Aluminum Framing:
1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
2. Fabricate frame assemblies with joints straight and tight fitting.
3. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
4. Seal horizontals and direct moisture accumulation to exterior.
5. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
6. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
7. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer.

8. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.
9. Provide thermally broken aluminum backer plate at perimeter of all windows and individual aluminum caps at the top of all vertical window frame mullions.
10. Provide fully soldered end dams at ends of subsill system.

D. Entrance Doors:
1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
2. Provide extruded aluminum glazing stops of square design, permanently anchored on security side and removable on opposite side.

E. Welding:
1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

F. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.08 HARDWARE

A. Receive hardware supplied in accordance with Section 08 7100 – Door Hardware and install in accordance with requirements of this Section.

B. Cut, reinforce, drill and tap frames and doors as required to receive hardware.

C. Comply with hardware manufacturer's templates and instructions.

D. Use concealed fasteners wherever possible.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 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. Install firestopping at each floor slab edge.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Pressure Plate Framing: Install glazing and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 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 4000 - Quality Requirements, for general testing and inspection requirements.

C. Air/Water Leakage Testing: Provide chamber test per ASTM E1105 at 10% of glazing area per building, to be performed at mockup, 35% and 50% completion.
   1. Testing to be performed at 0.67 times the ASTM E331 rated pressure provided by the manufacturer for the system, not less than 5.6 psf.

D. 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.

3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

3.06 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.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4435
PROTECTIVE FRAMED GLAZING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior protective framed glazing assembly.

B. Interior protective framed glazing assembly.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Steel attachment members.

B. Section 07 2500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

C. Section 07 8400 - Firestopping: Firestop at exterior wall assembly junction with structure.

D. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

E. Section 08 7100 - Door Hardware: Hardware installation requirements.

F. Section 08 8723 - Security Films.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

J. 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.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

L. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

M. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.

N. ITS (DIR) - Directory of Listed Products; current edition.

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

R. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 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 each affected installer.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide evidence of compliance with fire performance criteria and manufacturer's published product data on framing components, glazing, anchorage and fasteners, and doors, if any.

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. Samples: Accompanying the Shop Drawings, submit:
   1. Sample of each exposed member.
   2. Samples of finish, showing complete range of color from darkest to lightest proposed for use on this Work.
   3. Samples, when approved by the Architect, will be used to verify that the installed finish is within the approved range.

E. Design Data: Submit framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

F. Shop drawing sheets that include engineering information designed by the Contractor’s Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor’s Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

G. Test Reports: Submit results of full-size mock-up testing for criteria other than fire performance. Reports of tests previously performed on the same design are acceptable.

H. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

I. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Texas.

B. Testing of Full-Size Mock-up: Provide testing of full-size mock-up to ensure compliance with performance requirements of specified system by an independent testing agency for structural criteria.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience and approved by manufacturer.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide mock-up that includes components of the types specified, and assemble to illustrate complete assembly, including attachments, anchors, and perimeter sealant.

C. Locate on-site where directed. Accepted mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F, and maintain above this minimum temperature during and for 48 hours after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals 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 failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. 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

2.01 EXTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Manufacturers - Single Story Walls:
   1. McGrory Glass, Inc; forster thermfix vario Steel Fire-Rated Framing System by McGrory Glass: www.mcgrory.com/#sle.
   2. SAFTIFIRST, a division of O'Keeffe's Inc; GPX Architectural Series with fire resistive walls/windows: www.safti.com/#sle.
   3. Technical Glass Products; Fireframes Curtainwall Series with Fireframes Designer Series doors: www.fireglass.com/#sle.
   4. Vetrotech North America; VDS 60 with VDS doors: www.vetrotechusa.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.
   1. Glazing assemblies noted on the drawings as Type IGFPSE – Insulated Glass Fire-Protection-rated SEcurity.
   2. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" within internal spaces.
   3. 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.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.
   1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.

D. Forced Entry Resistance; Must comply with one of the following multiple impact test:
   1. FTD-SA - Filti Testing and Development Shooter Attack Certification Class 1.
   2. UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.

E. Structural Performance: Design and size components to withstand the following loading without damage or permanent set.
   1. Design Live Loads: Comply with requirements of ASCE 7
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths or 3/4 inch, whichever is less, under specified design load.
   4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
      c. Movement of wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.

F. Water Penetration: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 pound-force per square foot.
   2. Test Method: ASTM E331.

G. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

H. Thermal Performance:
   1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.02 INTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Manufacturers:
   1. McGrory Glass, Inc; forster fuego light Steel Fire-Rated Framing System by McGrory Glass: www.mcgrory.com/#sle.
   2. SAFTIFIRST, a division of O'Keeffe's Inc; GPX Architectural Series with temperature rise doors: www.safti.com/#sle.
   3. Technical Glass Products; Fireframes Designer Serieswith Fireframes Designer Series doors: www.fireglass.com/#sle.
   4. Vetrotech North America; VDS 60 or 120with VDS Doors: www.vetrotechusa.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.

C. Structural Performance: Design to support dead loads and horizontal live loads equivalent to the following; coordinate connection to main structural members.
   1. Design Live Loads: Comply with requirements of ASCE 7
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths or 3/4 inch, whichever is less, under specified design load.

D. Glazing
   1. Assemblies shall be glazed as required to meet ASTM E 119 and as as approved by the manufacturer fro the framing system to meet the hourly performance indicated.
   2. Properties:
      a. Individual Lites shall be permanently identified with a listing mark.

b. Glazing material installed in “Hazardous Locations” (subject to human impact) shall be certified to meet the applicable requirements for fire rated assemblies referenced in ANSI Z97.1 Standard for Safety Glazing Materials Used In Buildings and/or CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
c. Temperature rise on the unexposed side of glazing material shall be limited to 250 degrees Fahrenheit when required.
d. Visible daylight transmission: Tint-free and optically clear

3. Logo: Each piece of fire rated glazing shall be labeled with a permanent logo.
4. Where indicated on the drawings, provide Security Film as specified in Section 08 8723 - Security Films.

E. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.
1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.

2.03 COMPONENTS

A. Framing Members: Formed steel structural members with aluminum cladding and non-combustible thermally-resistive material as required for fire rating.
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 imposed loads.
2. Cross-Section: As indicated on drawings.
3. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Structural Supporting Anchors: See Section 05 1200.

E. Fasteners: Galvanized steel.
1. Arrange fasteners and attachments to conceal from view.

F. Exposed Flashings: 20 gauge, 0.032 inch thick aluminum sheet; finish to match framing members.

G. Concealed Flashings: 26-gauge, 0.018 inch thick galvanized steel.

H. Firestopping: See Section 07 8400.

I. Sealants Within Fire-Rated Assembly: As required by fire-rating and manufacturer's assembly.

J. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

K. Sealant for Setting Thresholds: Non-curing butyl type.

L. Sealants: See Section 07 9200 for additional information.

M. Glazing Gaskets: Type to suit application to achieve fire-rating, weather, moisture, and air infiltration requirements.

N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 DOORS AND HARDWARE

A. Doors: Glazed hollow steel.
1. Type: Manual swinging.

B. Door Hardware:
   1. Types: See Section 08 7100.

2.06 FINISHES

A. Finishing: Apply factory finish to surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural metal surfaces are visible in completed assemblies, including joint edges.

B. Aluminum Finish: Class I natural anodized.
   1. Apply factory finish to surfaces that will be exposed in completed assemblies.
   2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive work of this section; see Section 07 2500 for additional information.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install wall system in accordance with limitations of fire rating and 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. Install door hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.

H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch every 3 feet non-cumulative or 1/2 inch per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

B. Replace components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust doors for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished 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. Wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 6223
TUBULAR DAYLIGHTING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular daylighting device (TDD) systems with formed pan flashing.

1.02 RELATED REQUIREMENTS

A. Division 07 roofing sections for roofing terminations at tubular daylighting device (TDD) pan flashings.

1.03 REFERENCE STANDARDS

A. General: Applicable edition of references cited in this Section is current edition published on date of issue of Project specifications, unless otherwise required by building code in force.

B. American Architectural Manufacturers Association (www.aamanet.org), Window & Door Manufacturers Association (www.wdma.com) Canadian Standards Association, (www.csagroup.org/us/en/services):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/ Specification for Windows, Doors, and Skylights (NAFS)
   2. CSA A440S1-09 – Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440
   3. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

C. ASTM International: www.astm.org:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   3. ASTM D635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-supporting plastics in a Horizontal Position
   4. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
   5. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
   6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
   7. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings
   8. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
   9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
   10. ASTM E 408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
   11. ASTM E 1651-94(2004) - Standard Test Method for Total Luminous Reflectance Factor by Use of 30/t Integrating-Sphere Geometry
   12. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
   13. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

D. Code of Federal Regulations:
   1. 29 CFR 1910.23 (e)(8) - Occupational Safety and Health Standards for Walking-Working Surfaces to Guard Floor and Wall Openings and Holes

E. Illuminating Engineering Society of North America (IESNA): www.ies.org:
   1. IESNA – The Lighting Handbook.

F. National Fenestration Rating Council: www.nfrccommunity.org:
   1. NFRC 100 - Procedure for Determining Fenestration Product U-factors
   2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

G. National Fire Protection Association: www.nfpa.org:
   1. NFPA 70 - National Electrical Code

H. The Coatings Society (SSPC): www.sspc.org:
   1. SSPC-SP 12/NACE NO. 5 - Surface Preparation And Cleaning Of Metal

1.04 COORDINATION

A. Coordinate tubular daylighting device interior termination locations with structural layout, ceiling grid layouts, and other ceiling-mounted items.

B. General Contractor and HVAC Contractor shall coordinate pathways of mechanical and life safety equipment so that tubular daylight device pathways are free and clear.

1.05 PREINSTALLATION MEETINGS

A. Pre-Installation Conference: Conduct conference at Project site prior to delivery of tubular daylighting devices and installation of roof deck to locate and coordinate openings. The meeting shall include the Architect or Owner's Representative and representatives of all related trades including mechanical to:
   1. Coordinate between the at least the following trades.
      a. Roofers to cut holes in roof deck for TDDs, set and flash curbs to deck and install flashing
      b. Ensure clear paths for TDDs and coordinate with mechanical contractors and suppliers so as not to impede TDD pathways.
      c. Roofer to determine if openings need to be framed out for support

1.06 ACTION SUBMITTALS

A. Product Data: For tubular daylighting devices include standard construction details, product performance characteristics, and material descriptions, dimensions of individual components and profiles, and finishes.
   1. Include test reports of qualified independent testing agency or third party certificates verifying compliance with performance requirements.

B. Shop Drawings: For tubular daylighting device work - include generic CAD pdf of TDD model for project.
   1. If not basis of design, submitted alternate will need to include a lighting photometric study indicating compliance with performance requirements in accordance with IESNA. Include layout, spacing criteria and foot-candle report.

1.07 INFORMATIONAL SUBMITTALS

A. Buy American Act Certification: Submit documentation certifying that products comply with provisions of the Buy American Act 41 U.S.C 10a – 10d.

B. Warranty: Sample of special warranty.

1.08 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data.

1.09 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer listed in this Section with minimum 30 years' experience in the US manufacturing similar products in successful use on similar projects and able to provide tubular unit skylights meeting requirements.
   1. Approval of Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
      a. Completed and signed Substitution Request form.
      b. Product data, including photometric data and independent test data indicating compliance with requirements.
      c. Sample product warranty.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of tubular unit skylights that fail in materials or workmanship under normal use within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, dome, and other materials beyond normal weathering.
      b. Breakage of glazing.
   2. Warranty Period:
      a. Tubular Unit Skylight Assembly: 10 years from date of purchase.
      b. Tunnel Reflective Coating: 20 years from date of purchase.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Velux America, Inc.: www.veluxusa.com.
   1. Contact: Susan Flanagan; susan.flanagan@VELUX.com or 864-813-6896.

B. Solatube International, Inc: www.solatube.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Source Limitations: Obtain tubular unit skylights AND curbs through single source from single manufacturer.

2.02 TUBULAR DAYLIGHTING DEVICES

A. System Description: Tubular daylighting devices with exterior glazed dome, glazing retainers and gaskets, exterior curb counterflashing assembly with integral adjustable pivot device, reflective tunnel, interior diffuser assemblies, and accessories, as required to meet installation and performance requirements indicated.
   1. Basis of Design: Velux Model TCC Commercial Curb Mount Sun Tunnel Skylight.

B. Roof Dome Assembly: Transparent, UV-resistant dome with flashing base supporting dome, and top of tunnel.
   1. Unit Sizes: 22 inch diameter as indicated on Drawings.
   2. Dome Glazing: 0.125 inch minimum thickness injection molded transparent polycarbonate material; with UV-absorbing additive.
   3. Dome Seal: Adhesive-backed foam weatherstrip.
   4. Daylight Directing Device: 22-inch (559-mm) diameter, injection molded, impact modified acrylic prism array configured to direct low-angle sunlight into tunnel and re-reflect high solar heat gain sunlight to exterior.

C. Roof Curb Counterflashing: One-piece, formed low slope curb counterflashing suitable for installation on roof curb up to 60 deg. from horizontal.
   1. Material: Galvanized steel sheet, 0.023-inch/24-ga (0.58-mm) thick.

a. Dimensions: Curb-mounted, 31 inches square, as required for skylight unit sizes indicated on Drawings, with 3 inch vertical counterflashing lip.
b. Finish: Powder coat, gray.

2. Flashing Insulator: Manufacturer's standard closed-cell thermal isolation material affixed to underside of flashing.

D. Curb width and length designation shall be sized as indicated on drawings. Curb height shall be 12” inches to allow dome to sit 8” above roof deck and nominal curb thickness shall be 1.5 inches. IF thickness of insulation is greater than 4”, then curb height may need to be adjusted.

E. Aluminum Curb: Factory insulated aluminum curb, 1.5 inches in thickness with 22 gauge (0.025”) white finished aluminum interior and 20 gauge 0.032”mill finished aluminum exterior. Curb factory insulated with 1.5 inches of expanded polystyrene board having a 5.8 R-value. Width and length of curb shall be as indicated with 12” inch curb height or as noted above. Curb roof mounting flange shall be a minimum 2.75 inches in width. Basis of Design: VELUX America LLC.

1. Intermediate Ring: High-impact plastic reflective tunnel receiver attached to top of roof flashing serving as mounting base for dome assembly and providing a thermal break between flashing and reflective tunnel, configured to channel condensed moisture out of assembly.
   a. Intermediate Ring Seal: Santoprene O-ring providing weather tight seal with roof flashing.
   b. Pivot Ring and Reflective Tunnel Collar: High-impact plastic pivoting socket mounts in intermediate ring and secures to factory-installed tunnel collar; adjustable to allow increased adjustability for proper alignment of tunnel sections.

F. Reflective Tunnel: Skylight light shaft formed from Class II anodized aluminum sheet, 0.016-inch/26-ga. (0.02 inch) thick, with silver specular interior finish surface coated with vacuum-evaporated silicone oxide and titanium oxide protective surface that protects the tunnel surface from corrosion and provides a long life of reflection characteristics.

1. Diameter: As required for 22” tubular daylighting device size.
2. Reflectance: 99 percent reflectance when measured in accordance with ASTM E 1651 at 30 degrees from vertical. Total reflectance greater than 98 percent when measured in accordance with ASTM E 1651.
3. Color Rendition, ASTM E 408: As defined by CIE L*a*b* color model, L equal to 99-100, values a* and b* shall not exceed +1 or be less than -1.

G. Reflective Tunnel Components: Provide components indicated and as required for installation based upon roof, ceiling, and structural member configuration, skylight and diffuser locations indicated on Drawings, and manufacturer's recommendations, selected from the following:

1. Rigid Tunnel Extensions: Reflective extension tube, lengths as required for application.
2. Universal Reflective Elbows: Reflective angle adaptors adjustable to 45 degrees, 0.023-inch/24-ga. (0.02 inch) thick, and mounted at the top, middle, or bottom of reflective tunnel assemblies as required for application.
3. Reflective Tunnel Fastening System: Manufacturer's recommended fastening devices consisting of spring tempered stainless steel pull clip mechanical fasteners allowing tunnel vertical and horizontal joints to be secured without the use of screws or tools, used in conjunction with pre-located punched holes in tunnel sections, that allow for a tight naturally-occurring tapered mating of interconnecting tunnel sections and elbows.

H. Reflective Tunnel Accessories: Provide accessories indicated and as required for installation based upon roof, ceiling, and structural member configuration, skylight and diffuser locations indicated on Drawings, and manufacturer's recommendations, selected from the following:

1. Rotating Couplers: Rotating adaptors allowing coupling of two elbows to create 90 degree transition of tunnels using fastening system connections with rotating joint enabling alignment of tunnel sections.

2. Commercial Energy Kit: Two clear diffusers mounted in airtight Santoprene gasketing system inserted in a round polymer housing that provides a thermal break and installs in line with building envelope insulation to isolate tunnel from exterior temperatures. Kit is affixed to tunnel with manufacturer's spring lock fasteners.

2.03 DIFFUSERS

A. Round Diffuser Assemblies for Exposed Structure Applications in Acoustical Cloud Ceiling: Round diffuser attached directly to bottom of tunnel, with high visible light transmittance lens, airtight seals, and white polycarbonate trim ring.
   1. Round Diffuser for Acoustical Cloud Ceiling
   2. Size: As required for 22” diameter tubular daylighting device
   3. Lens Type: Frosted lens, minimum 92 percent visible light transmittance

B. Round Diffuser Assemblies for Finished Ceiling Applications in Specialty Linear Metal Ceiling: Round ceiling diffuser assembly attached directly to bottom of tunnel, dual high visible light transmittance lenses with insulating airspace, airtight seals, and paintable white acrylic trim ring.
   1. Round Diffuser for Specialty Linear Metal Ceiling
   2. Size: As required for 22” tubular daylighting device
   3. Lens Type: frosted lens, minimum 92 percent visible light transmittance

2.04 ACCESSORIES

A. Suspension Wire: 12-ga., galvanized steel wire.

2.05 PERFORMANCE REQUIREMENTS

A. Tubular Daylighting Device, 22 inch Unit: AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS-11 or previous):
   1. Performance Grade (Primary Designator): TDDCC/TDDOC-PG130.
   2. Design Pressure (DP): +300/-130 psf (+14.4/-1 psi).
   3. Water Test Pressure: 15 psf (0 psi) with no leakage at 5 gallons per minute spray rate.
   4. Air Leakage Rate: 0.30 cfm/ft2 maximum

B. Daylighting: Provide daylighting photometric performance comparable to basis of design product at layout indicated, based upon daylighting profile of March 21, 12pm local time, at Project location by simulation in accordance with IESNA guidelines.

C. Air Infiltration: Maximum air leakage through unit of 0.30 cfm/sq. ft. (1.5 L/s/sq. m) of fixed area as determined according to ASTM E 283 at a static-air-pressure differential of 1.57 lbf/sq. ft. (75Pa.)

D. Water Penetration under Static Pressure: No evidence of water penetration through unit when tested according to ASTM E331 at a static-air-pressure differential of 15 lbf/sq. ft. (720 Pa).

E. Windborne-Debris Resistance: Provide tubular unit skylights capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed representative of those specified, according to ASTM E1886 and ASTM E1996.
   1. Missile Level C, Wind Zone 3 requirements, and +50/-50 psf cycle pressure minimum.

F. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing meeting NAFS and identical to specimens tested for fire-exposure behavior in accordance with test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Self-Ignition Temperature: 650 deg F (345 deg. C) or more for plastic glazing in thickness indicated when tested per ASTM D1929.
   2. Smoke-Production Characteristics: Comply with either requirement below:
      a. Smoke-Developed Index: 450 or less when tested per ASTM E84 on plastic glazing in manner indicated for application.

b. Smoke Density: 75 or less when tested per ASTM D2843 on plastic glazing in thickness indicated for application.

3. Burning Characteristics: Tested and labeled in accordance with ASTM D635.
   a. Plastic Glazing for Domes: Polycarbonate Class CC1

G. Fire Ratings for Roof Assemblies with Fire Classifications: Tubular unit skylight with dome edge protection band tested in accordance with ASTM E108 and listed as passing Burning Brand test with target classification of Class B

H. Energy Performance with Energy Kit Installed:
1. Thermal Transmittance: NFRC 100 maximum U-factor:
   a. 22 inch Units: 0.43 Btu/hr*ft2*deg F (2.44 W/m2*deg C).
2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC:
   a. 22 inch Units: 0.26.

I. Fall Protection Standard Compliance: 29 CFR 1910.23: Passed.

2.06 MATERIALS

A. Galvanized-Steel Sheet: ASTM A653/A653M, G90 (Z275) coating, either commercial steel or forming steel.

B. Aluminum Sheet: Flat sheet complying with ASTM B209/B209M.

C. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil dry film thickness per coating.

D. Joint Sealants: As specified in Section 079200 "Joint Sealants."

E. Mastic Sealants: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

2.07 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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. Galvanized Steel Sheet:
1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0 inch). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color and Gloss: Neutral gray.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with tubular unit skylight installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install tubular daylighting devices in accordance with manufacturer's written instructions and approved shop drawings. Coordinate installation of units with installation of substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that finished installation is weather tight.

1. Anchor tubular unit skylights securely to supporting substrates.
2. For horizontal installation, install tubular daylighting devices true to line and without distortion.

B. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by tubular unit skylight manufacturer.

C. Tubing needs to be wrapped with batt insulation in return air plenum spaces to prevent condensation. TDD installer will need to provide the insulation.

D. Installer will need to account for and be prepared to pack fibrous insulation in rough opening of curb to maintain continuity of thermal barriers.

E. Coordinate attachment and seal of perimeter air and vapor barrier material.

F. For TDDs in Specialty Linear Metal Ceiling – diffuser is to be installed flush against the ceiling

G. For TDDs in Acoustical Cloud Ceiling – TDD tubing is to terminate 4” below acoustical ceiling tile. Please speak with architect for clarification.

3.03 CLEANING AND PROTECTION

A. Clean exposed tubular unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Replace glazing that has been damaged during construction period.

C. Dimmer Assemblies: Test and adjust dimmer assemblies for proper operation.

D. Protect tubular unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

SECTION 08 7100
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. Automatic operators.
4. 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 08 Section “Automatic Door Operators”.
5. 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. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. 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 overhead 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.
e. Four hinges at 4’0” wide doors
f. Four hinges at aluminum doors.

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. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

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. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

A. 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.

1. Manufacturers:

   a. Sargent Manufacturing (SA).
   b. No Substitution.

B. 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. Keyway:.Match Facility Standard.
6. At integrated access control locks and exits, permanent cores to be provided by 087100.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. 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. Existing System: Field verify and key locks to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).

3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

F. Construction Keying: Provide temporary keyed construction cores. Contractor is responsible for removing construction cores and installing permanent cores. Credit to be provided to the owner once the construction cores are removed.

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).
b. MMF Industries (MM).
c. Telkee (TK).

I. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

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 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 8200 Series.
    b. No Substitution.

2.8 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.

2.9 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. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

7. 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.

8. 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.

9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

11. Rail Sizing: Provide exit device rails factory sized for proper door width application.

12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

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.

2.10 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 80 Series.
   b. No Substitution.

2.11 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. 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.

2.12 ELECTROHYDRAULIC DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Norton Door Controls (NO) - 6000 Series.

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. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Power Supplies

1. By security contractor

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.

C. 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.
2. All quick connection below the ceiling to be made by hardware installer at the time of installation.

D. 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.

E. 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.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. 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.

3.3 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.

3.4 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.

3.5 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.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 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.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate selection for the material and application.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. SA - SARGENT
3. RO - Rockwood
4. NO - Norton
5. PE - Pemko
6. OT - Other
7. SU - Securitron

Creekwood Middle School

Hardware Sets based on plans dated 06/13/2023 – Draft – Not for construction.

Set: 1.0
Doors: A132, E100A, E101B
Description: Exterior Alum Pair - Access Control

8	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Removable Mullion	L980S	US28	SA
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Rim Exit Device, Dummy	16 TB 43 55 8810 862	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
4	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
2	Drop Plate	351D as required	EN	SA
2	Kit	581-2	EN	SA
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	By door mfgr		OT
1	Rain Guard	346C		PE
2	Sweep	3452AV		PE
3	Elec Cables - Exit to Hinge	QC-CxxxP		MK
2	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
2	Electric Power Transfer	EL-CEPT	630	SU

Notes: Timer is by security contractor.
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.

Confirm hardware compatibility with aluminum door manufacturer.

Set: 2.0
Doors: A133
Description: Exterior HM Pair Exit - Access Control

6	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Removable Mullion	L980S	PC	SA
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Rim Exit Device, Dummy	16 TB 43 55 8810 862	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
4	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
2	Sweep	3452AV		PE
1	Astragal Set (2)	18041CNB		PE
3	Elec Cables - Exit to Hinge	QC-CxxxP		MK
2	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
2	Electric Power Transfer	EL-CEPT	630	SU

Notes: Confirm hardware compatibility with door manufacturer. Wide stile required.

Set: 3.0
Doors: A140
Description: Exterior HM Exit Access Control

3	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
1	Sweep	3452AV		PE
2	Elec Cables - Exit to Hinge	QC-CxxxP		MK
1	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
1	Electric Power Transfer	EL-CEPT	630	SU

Set: 4.0
Doors: E104A
Description: Exterior Sgl Alum - Access Control

4	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Kit	581-2	EN	SA
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	By door mfgr		OT
1	Rain Guard	346C		PE
1	Sweep	3452AV		PE
2	Elec Cables - Exit to Hinge	QC-CxxxP		MK

1	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
1	Electric Power Transfer	EL-CEPT	630	SU

Notes: Verify all existing conditions prior to ordering hardware. Confirm hardware compatibility with door manufacturer. Wide stile required.

Set: 5.0
Doors: E103
Description: Exterior HM - Lock - DPS

4	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
1	Sweep	3452AV		PE
1	Position Switch	DPS-M-BK		SU

Set: 5.1
Description: Pair Alum - Corr / Gym / Cafeteria - MHO

8	Hinge (heavy weight)	T4A3786 4 1/2" x 4 1/2"	US26D	MK
1	Removable Mullion	L980S	US28	SA
2	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
5	Small Format Inter Core	7P-7300B	US15	SA
2	Door Closer	TB 351 O / PS as req	EB	SA
2	Kit	581-2	EN	SA
2	Electromagnetic Holder	990 Series	689	RF
1	Perimeter Seal	By door mfgr		OT

Notes: Doors are held open. Upon loss of power or signal from fire control, doors will close and latch. Wiring is by others.

Set: 6.0
Doors: E101, E101A, E104
Description: Pair - Corr / Gym / Classroom / Cafeteria

6	Hinge (heavy weight)	T4A3786 4 1/2" x 4 1/2"	US26D	MK
1	Removable Mullion	L980S	US28	SA
2	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
5	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
2	Silencer	608		RO

Set: 7.0
Doors: E100
Description: Pair - Corr / Gym / Cafeteria - MHO

6	Hinge (heavy weight)	T4A3786 4 1/2" x 4 1/2"	US26D	MK

1	Removable Mullion	L980S	US28	SA
2	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
5	Small Format Inter Core	7P-7300B	US15	SA
2	Door Closer	TB 351 UO / PS as req	EB	SA
2	Electromagnetic Holder	990 Series	689	RF
2	Silencer	608		RO

Notes: Doors are held open. Upon loss of power or signal from fire control, doors will close and latch. Wiring is by others.

Set: 8.0
Doors: E105
Description: Pair Mech/Elec - Outswing

6	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Overhead Stop	590S	US26D	SA
1	Surface Closer	TB 351 PS	EN	SA
1	Perimeter Seal	S88BL		PE
1	Astragal	355CS		PE

Notes: Closer on active leaf, overhead stop on inactive.

Set: 9.0
Doors: A142
Description: Pair Storage

6	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
2	Door Stop	481	US26D	RO
2	Silencer	608		RO

Set: 10.0
Doors: A141, B114, E102, E110
Description: Storage

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 11.0
Doors: E106, E107
Description: Storage - Closer - Gasket

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK

1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
1	Perimeter Seal	S88BL		PE

Set: 12.0
Doors: A135
Description: Office

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Office/Entry Lock	72 8205 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 13.0
Doors: A134
Description: Large Classroom - STC

3	Hinges	By the door manufacturer		OT
1	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
2	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 UO / PS as req	EB	SA
1	Gasket, door bottom, threshold	By 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: 14.0
Doors: A110
Description: Classroom - Closer / Stop

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Classroom Lock	72 8237 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
3	Silencer	608		RO

Set: 15.0
Doors: B111, B112, B112A
Description: Classroom - Closer

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Classroom Lock	72 8237 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 16.0
Doors: A137, A138, A139
Description: Practice - STC

3	Hinges	By STC Door Manufacturer		OT
1	Passage Set	8215 LNJ	US26D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
1	Gasket, door bottom, threshold	By STC Door Manufacturer		OT

Notes: Hinges, threshold, door bottom and sound seals by door mfgr.

Set: 17.0
Doors: E108, E109
Description: Shared Restroom/Locker / Dressing P/P

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Push Plate	70E	US32D	RO
1	Pull Plate	111x70C	US32D	RO
1	Door Closer	TB 351 UO / PS as req	EB	SA
1	Door Stop	481	US26D	RO
1	Perimeter Seal	S88BL		PE

Set: 18.0
Doors: E103A
Description: OH/Coiling - Cylinder

1	Mortise Cylinder	72 41	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA

Notes: Balance of hardware by door mfgr. Verify cylinder type and cam required.

Set: 19.0
Doors: A132A, E100B, E100C
Description: Rated Aluminum

1	Small Format Inter Core	7P-7300B	US15	SA
1	Balance hardware	by the door manufacturer		OT

Set: 20.0
Doors: D104G
Description: Not Found

1	Doors not found.	Not found		OT

Notes: Balance of hardware by door mfgr.

Riverwood Middle School

Hardware Sets based on plans dated 06/13/2023 – Draft – Not for construction.

Set: 1.0
Doors: A132, E100A, E101B
Description: Exterior Alum Pair - Access Control

8	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Removable Mullion	L980S	US28	SA
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Rim Exit Device, Dummy	16 TB 43 55 8810 862	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
4	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
2	Drop Plate	351D as required	EN	SA
2	Kit	581-2	EN	SA
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	By door mfgr		OT
1	Rain Guard	346C		PE
2	Sweep	3452AV		PE
3	Elec Cables - Exit to Hinge	QC-CxxxP		MK
2	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
2	Electric Power Transfer	EL-CEPT	630	SU

Notes: Timer is by security contractor.
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.

Confirm hardware compatibility with aluminum door manufacturer.

Set: 2.0
Doors: A133
Description: Exterior HM Pair Exit - Access Control

6	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Removable Mullion	L980S	PC	SA
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Rim Exit Device, Dummy	16 TB 43 55 8810 862	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
4	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
2	Sweep	3452AV		PE
1	Astragal Set (2)	18041CNB		PE
3	Elec Cables - Exit to Hinge	QC-CxxxP		MK
2	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT

2	Electric Power Transfer	EL-CEPT	630	SU

Notes: Confirm hardware compatibility with door manufacturer. Wide stile required.

Set: 3.0
Doors: A137
Description: Exterior HM Exit Access Control

3	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
1	Sweep	3452AV		PE
2	Elec Cables - Exit to Hinge	QC-CxxxP		MK
1	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
1	Electric Power Transfer	EL-CEPT	630	SU

Set: 4.0
Doors: E104A
Description: Exterior Sgl Alum - Access Control

4	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Rim Exit Device	TB 43 72 56-SN200-8804 862	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Kit	581-2	EN	SA
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	By door mfgr		OT
1	Rain Guard	346C		PE
1	Sweep	3452AV		PE
2	Elec Cables - Exit to Hinge	QC-CxxxP		MK
1	Elec Cables - Hinge to Above	QC-C1500P		MK
1	Power Supply	By Security Contractor.		OT
1	Electric Power Transfer	EL-CEPT	630	SU

Notes: Verify all existing conditions prior to ordering hardware. Confirm hardware compatibility with door manufacturer. Wide stile required.

Set: 5.0
Doors: E103
Description: Exterior HM - Lock - DPS

4	Hinge (heavy weight)	T4A3386 NRP 4 1/2" x 4 1/2"	US32D	MK
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Perimeter Seal	2891APK		PE
1	Sweep	3452AV		PE

1	Position Switch	DPS-M-BK		SU

Set: 6.0
Doors: E101, E101A, E104
Description: Pair - Corr / Gym / Classroom / Cafeteria

6	Hinge (heavy weight)	T4A3786 4 1/2" x 4 1/2"	US26D	MK
1	Removable Mullion	L980S	US28	SA
2	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
5	Small Format Inter Core	7P-7300B	US15	SA
2	Surface Closer	TB 351 CPS brkt/spacer as req	EN	SA
2	Silencer	608		RO

Set: 7.0
Doors: E100
Description: Pair - Corr / Gym / Cafeteria - MHO

6	Hinge (heavy weight)	T4A3786 4 1/2" x 4 1/2"	US26D	MK
1	Removable Mullion	L980S	US28	SA
2	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
1	Mullion Cylinder	72 980C1	US26D	SA
5	Small Format Inter Core	7P-7300B	US15	SA
2	Door Closer	TB 351 UO / PS as req	EB	SA
2	Electromagnetic Holder	990 Series	689	RF
2	Silencer	608		RO

Notes: Doors are held open. Upon loss of power or signal from fire control, doors will close and latch. Wiring is by others.

Set: 8.0
Doors: E105
Description: Pair Mech/Elec - Outswing

6	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Surface Overhead Stop	590S	US26D	SA
1	Surface Closer	TB 351 PS	EN	SA
1	Perimeter Seal	S88BL		PE
1	Astragal	355CS		PE

Notes: Closer on active leaf, overhead stop on inactive.

Set: 9.0
Doors: A142
Description: Pair Storage

6	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA

1	Small Format Inter Core	7P-7300B	US15	SA
2	Door Stop	481	US26D	RO
2	Silencer	608		RO

Set: 10.0
Doors: A141, B110, B114, E102, E110
Description: Storage

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 11.0
Doors: E106, E107
Description: Storage - Closer - Gasket

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Storeroom/Closet Lock	72 8204 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
1	Perimeter Seal	S88BL		PE

Set: 12.0
Doors: A135
Description: Office

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Office/Entry Lock	72 8205 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 13.0
Doors: A134
Description: Large Classroom - STC

3	Hinges	By the door manufacturer		OT
1	Rim Exit Device, Classroom	16 TB 43 72 8813 ETJ	US32D	SA
2	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 UO / PS as req	EB	SA
1	Gasket, door bottom, threshold	By 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: 15.0
Doors: B111, B112, B112A
Description: Classroom - Closer

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK

1	Classroom Lock	72 8237 LNJ	US26D	SA
1	Small Format Inter Core	7P-7300B	US15	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

Set: 16.0
Doors: A136, A138, A140
Description: Practice - STC

3	Hinges	By STC Door Manufacturer		OT
1	Passage Set	8215 LNJ	US26D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	481	US26D	RO
1	Gasket, door bottom, threshold	By STC Door Manufacturer		OT

Notes: Hinges, threshold, door bottom and sound seals by door mfgr.

Set: 17.0
Doors: E108, E109
Description: Shared Restroom/Locker / Dressing P/P

3	Hinge, Full Mortise	TA2714 4 1/2" x 4 1/2"	US26D	MK
1	Push Plate	70E	US32D	RO
1	Pull Plate	111x70C	US32D	RO
1	Door Closer	TB 351 UO / PS as req	EB	SA
1	Door Stop	481	US26D	RO
1	Perimeter Seal	S88BL		PE

Set: 18.0
Doors: E103A
Description: OH/Coiling - Cylinder

1	Mortise Cylinder	72 41	US32D	SA
1	Small Format Inter Core	7P-7300B	US15	SA

Notes: Balance of hardware by door mfgr. Verify cylinder type and cam required.

Set: 19.0
Doors: A132A, E100B, E100C
Description: Rated Aluminum

1	Small Format Inter Core	7P-7300B	US15	SA
1	Balance hardware	by the door manufacturer		OT

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated glass units.

B. Glazing units.

C. Decorative films.

D. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

E. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.

F. Section 08 8300 - Mirrors.

G. Section 08 8723 - Security Films.

H. Section 08 8813 - Fire-Rated Glazing.

I. Section 08 8856-Security Glazing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1036 - Standard Specification for Flat Glass; 2016.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

K. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.

L. GANA (GM) - GANA Glazing Manual; 2008.

M. GANA (SM) - GANA Sealant Manual; 2008.

N. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

P. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

S. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 4 by 6 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
    a. Insulating Glass Certification Council (IGCC).
    b. Safety Glazing Certification Council (SGCC).

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience and approved by manufacturer.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide on-site glazing mock-up with the specified glazing components.

C. Locate where directed.

D. Mock-ups may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
1. Oldcastle BuildingEnvelope: www.obe.com.
2. Viracon, Inc: www.viracon.com/#sle.
3. Other Fabricators as approved by the Float Glass Manufacturer.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Float Glass Manufacturers:
1. AGC Glass North America, Inc: www.agcglass.com/#sle.
2. Guardian Glass, LLC: www.guardianglass.com/#sle.
3. Pilkington North America Inc: www.pilkington.com/na/#sle.
4. Saint Gobain North America: www.saint-gobain.com/#sle.
5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

C. Decorative Film Manufacturers:
1. 3M Window Film: solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.
2. Decorative Films, LLC.: www.decorativefilm.com.
3. Madico, Inc.: www.madico.com.
4. Saint-Gobain/Solar Gard: www.solargard.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with applicable codes.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Glass thicknesses listed are minimum. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations for span width and height of each installation.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

D. Fully Tempered Safety Glass: Shall meet impact resistance per ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   2. Fully Tempered Safety Glass: Shall meet impact resistance per ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.
   3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
   4. Thicknesses: Glass thicknesses listed are minimum. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations for span width and height of each installation.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATED GLASS UNITS

A. Manufacturers:
   1. Glass: Any of the manufacturers specified for float glass, unless specifically required by manufacturer's tested assembly.

B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

C. Insulated Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Aluminum.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
      b. Color: Black.
   6. Space between lites filled with air.
   7. Purge interpane space with dry air, hermetically sealed.
   8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
      a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.

D. Type IGU - Insulated Glass Units:
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Light Gray Appearance.
      b. Coating: Low-E (passive type), on #2 surface.
   3. Metal edge spacer.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, maximum.
7. Visible Light Transmittance (VLT): 36 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.23, maximum.
9. Visible Light Reflectance, Outside: 13 percent, maximum.
10. Glazing Method: Dry glazing method, gasket glazing.

E. Type IGSEF - Insulated Glass with applied SEcurity Film
1. Applications: Where indicated on the drawings.
2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Light Gray Appearance.
b. Coating: Low-E (passive type), on #2 surface.
3. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
b. Provide Security Film as specified in 08 8723-Security Films.
c. Apply Security Film on #4 surface.
4. Total Thickness: 1 inch.
5. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, maximum.
6. Visible Light Transmittance (VLT): 36 percent, minimum.
7. Solar Heat Gain Coefficient (SHGC): 0.23, maximum.
8. Visible Light Reflectance, Outside: 13 percent, maximum.
9. Forced Entry Resistance; Must comply with one of the following multiple impact test:
a. FTD-SA - Filti Testing and Development Shooter Attack Certification Class 1.
b. UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.
10. Wet Glaze Anchoring System: Structural Silicone Sealant/Adhesive.
a. Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

F. Type IGDF - Insulated Glass with applied Decorative Film:
1. Applications: Where indicated on the drawings.
2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Light Gray Appearance.
b. Coating: Low-E (passive type), on #2 surface.
3. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
b. Provide Decorative Film as specified on #4 surface.
c. Applied film shall be UV resistant.
4. Total Thickness: 1 inch.
5. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, maximum.
6. Visible Light Transmittance (VLT): 36 percent, minimum.
7. Solar Heat Gain Coefficient (SHGC): 0.23, maximum.
8. Visible Light Reflectance, Outside: 13 percent, maximum.

G. Type IGS - Insulated Glass Spandrel:
1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Light Gray Appearance.
b. Coating: Same as Type IGU, on #2 surface.
3. Metal edge spacer.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
a. Tint: Clear.
b. Opacifier: Ceramic frit, on #4 surface.

c. Opacifier Color: Match Type IGU.
5. Total Thickness: 1 inch.
6. Glazing Method: Dry glazing method, gasket glazing.

2.05 GLAZING UNITS

A. Type GTC - Glass Tempered Clear:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, minimum.

B. Type GLSA - Glass Laminated SAfety:
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Thickness: 1/2 inch, nominal.
a. Outer Lite: Fully Tempered glass.
b. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
c. Inside Lite: Tempered glass.

C. Type GDF - Glass with applied Decorative Film:
1. Applications: Locations as indicated on drawings..
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, minimum.
5. Provide Decorative Film as scheduled on the drawings and specified in this Section.
6. Apply Film to secure side of glass.

D. Type GIBJ - Glass Interior Butt Joint:
1. Applications: As scheduled.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: Glass thickness shall be per GANA and manufacturers recommendations for span width and height of each installation. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations.
5. Glazing Method: Butt joint glazing method, sealant only.
6. Provide 3/8" gap between glazing panels or as required by the manufacturer.

2.06 DECORATIVE FILMS

A. View Control Plastic Film: Polyester type, UV Resistant.
1. Applications: Locations as indicated on drawings.
2. Series Type: See drawings for Schedule of Materials and Colors..
3. Color: Acid Etch.
4. Thickness: 0.002 inch, minimum.
5. Adhesive Type: Pressure-sensitive.

2.07 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

C. Silicone Structural Sealant: Single component; neutral curing; designed specifically for structural bonding applications of glass; ASTM C920 Type S, Grade NS, Class 50, Uses NT, A, and G; with cured Shore A hardness range of 40; color as selected.
   1. Basis of Design: Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

2.08 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - BUTT JOINT GLAZING METHOD (SEALANT ONLY)

A. Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.

B. Temporarily secure a small diameter nonadhering foamed rod on back side of joint.

C. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.

D. Permit sealant to cure then remove foam backer rod, and then apply sealant to opposite side, tool smooth to concave profile.

E. Remove masking tape.

3.06 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unframed Mirrors.
   1. Tempered glass.

1.02 RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Framed mirrors at restrooms.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

D. GANA (GM) - GANA Glazing Manual; 2008.

E. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

A. See Section 01 3000 - 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, 4 x 6 inch 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.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 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; Type MIR: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
   1. Applications: Provide and install mirrors on wall where noted on drawings as Unframed Mirror.
   2. Thickness: 1/4 inch.
   3. Edges: Ground.
   4. Size: As indicated on drawings.

2.02 GLAZING COMPOUNDS

A. 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.

2.03 ACCESSORIES

A. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.

B. Glazing Clips: Manufacturer's standard type.

C. Mirror Attachment Accessories: Stainless steel clips.

D. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 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. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.

3.04 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

SECTION 08 8723
SECURITY FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing film applied to existing and new glazing assemblies.

B. All film and anchoring shall be field installed by qualified and certified applicators.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: New doors with glazing to receive film.

B. Section 08 4313-Aluminimum-Framed Storefronts: New glazing to receive film.

C. Section 08 4413 - Glazed Aluminum Curtain Walls: New glazing to receive film.

D. Section 08 8000 - Glazing: New glazing to received film.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

E. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.

F. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Record of product certification for safety requirements.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Detailing installation of film, anchoring accessories, and sealant.

D. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.

E. Samples, Supplemental Anchors: Where supplemental anchors are necessary to achieve specified performance submit detailed information in accordance with substitution procedures; include two samples, minimum length 2 inches.

F. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.

G. Specimen Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.

1.06 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 authorities having jurisdiction.

1.07 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.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. 3M Window Film: www.solutions.3m.com/#sle.

B. Armoured One: www.armouredone.com/#sle.

C. Madico, Inc: www.madico.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SECURITY FILM

A. Security Film: Transparent polyester security film for permanent bonding to glass.
   1. Basis of Design: 3M, S140 transparent security film for permanent bonding to glass.
   2. Thickness: 0.014 inch, minimum.
   3. Color: Clear.
   4. Construction: Multi-ply laminate.
   5. Adhesive Type: Pressure sensitive acrylic.
   6. Tensile Strength: 25,000 psi minimum when tested in accordance with ASTM D882.
   7. Breaking Strength: 350 psi when tested in accordance with ASTM D882.
   8. Forced Entry Resistance; Must comply with one of the following multiple impact test:
      a. FTD-SA - Filti Testing and Development Shooter Attack Certification Class 1.
      b. UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.
   9. 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).
   10. Anchoring System: Provide silicone structural sealant attachment system installed per manufacturers recommendations.

B. Accessory Materials: As recommended or required by film manufacturer.

C. Supplementary Anchors: As required by performance criteria and acceptable to Architect.

D. Silicone Structural Sealant: Self-priming, elastomeric adhesive complying with ASTM C1184.
   1. Silicone Structural Sealant: Single component; neutral curing; designed specifically for structural bonding applications of glass; ASTM C920 Type S, Grade NS, Class 50, Uses NT, A, and G; with cured Shore A hardness of 40; color as selected.
   2. Basis of Design: Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

E. Glass Cleaner: As recommended by glazing film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field -Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.

C. Verify glass is not cracked, chipped, broken, or damaged.

D. Verify that frames are securely anchored and free of defects.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

A. Do not apply glazing film when surface temperature is less that 40 degrees F or if precipitation is imminent.

B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

C. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.

D. Structural Sealant and Supplemental Anchors: Install in accordance with manufacturer's instructions and shop drawings.

E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.

F. Remove labels and protective covers.

3.04 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

SECTION 08 8813
FIRE-RATED GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated glazing units.

B. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.

C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 4435 - Protective Framed Glazing Assemblies: Glazing tested and provided as part of the wall assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

F. GANA (GM) - GANA Glazing Manual; 2008.

G. GANA (SM) - GANA Sealant Manual; 2008.

H. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

K. ITS (DIR) - Directory of Listed Products; current edition.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

M. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2017.

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

P. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

R. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Two samples 4 by 6 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Specimen warranty.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulating Glass Certification Council (IGCC).
      b. Safety Glazing Certification Council (SGCC).

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide on-site glazing mock-up with specified glazing components.

C. Locate where directed.

D. Mock-ups may remain as part of work.

1.08 FIELD CONDITIONS

A. Ambient Conditions: Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire-Resistance-Rated Glass:
   1. Fabricators:
      a. GGI - General Glass International: www.generalglass.com/#sle.
      b. McGrory Glass, Inc: www.mcgrory.com/glass/fire-resistant-glass-agc-pyrobel/#sle.
   2. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: www.safti.com/#sle.
      b. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
      c. Vetrotech North America; Contraflam 60: www.vetrotechusa.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire-Protection-Rated Glass:
1. Fabricators:
a. GGI - General Glass International: www.generalglass.com/#sle.
b. McGrory Glass, Inc: www.mcgrory.com/glass/fire-rated-glass-schott-pyran-platinum/#sle.
2. Manufacturers:
a. McGrory Glass, Inc: www.mcgrory.com/fire-rated-glass/#sle.
b. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
c. SCHOTT North America Inc: www.us.schott.com/#sle.
d. Technical Glass Products: www.fireglass.com/#sle.
e. Vetrotech North America: www.vetrotechusa.com/#sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLAZING UNITS

A. Type GFRR - Glass Fire-Resistance-Rated: Type, thickness, and configuration of glazing that contains flames, smoke, and blocks radiant heat, as required to achieve indicated fire rating period exceeding 45 minutes.
1. See Section 08 4435 for glazing in fire-rated framing assemblies.
2. Applications:
a. Glazing in fire-rated door assembly.
b. Glazing in fire-rated window assembly.
c. Glazing in sidelites, borrowed lites, and other glazed openings in fire-rated wall assemblies.
d. Other locations as indicated on drawings.
3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
4. Safety Glazing Certification: 16 CFR 1201 Category II.
5. Glazing Method: As required for fire rating.
6. Fire Rating Period: As indicated on drawings.
7. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
d. 'T' - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
e. "XXX" - placeholder that represents fire rating period, in minutes.

B. Type GFPR - Glass Fire-Protection-Rated: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period as indicated on drawings.
1. Applications:
a. Glazing in fire-protection-rated door assembly.
b. Glazing in fire-protection-rated window assembly.
c. Other locations as indicated on drawings.
2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
3. Safety Glazing Certification: 16 CFR 1201 Category II.

4. Glazing Method: As required for fire rating.
5. Fire-Rating Period: As indicated on drawings.
6. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
   a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
   b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
   c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
   d. "XXX" - placeholder that represents fire-rating period, in minutes.

2.03 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.04 ACCESSORIES

A. Setting Blocks: Neoprene, EPDM, or silicone, with 70 to 90 Shore A durometer hardness. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape: Closed-cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect air barrier and vapor retarder seal.

D. Glazing Gaskets: Flexible intumescent seals.
   1. Material: Co-extruded intercalated graphite combined with thermoplastic lip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that minimum required face and edge clearances are provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than four days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

A. After installation, mark pane with 'X' by using removable plastic tape or paste; do not mark heat-absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Exterior gypsum sheathing.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

E. 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; 2018.

F. 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; 2020.

G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

N. ASTM E413 - Classification for Rating Sound Insulation; 2016.

O. GA-214 - Levels of Finish for Gypsum Panel Products; 2021.

P. GA-216 - Application and Finishing of Gypsum Panel Products; 2018.

Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

B. Product Qualifications:
   1. Single Source Responsibility:
      a. Obtain gypsum board products, joint treatment products, and textured coatings from a single manufacturer.

C. Mock-ups
   1. At an area on the site where approved by the Architect, provide a mock-up gypsum wallboard panel.
      a. Make the panel approximately 4'-0" square.
      b. Provide one mock-up panel for each gypsum wallboard finish used on the Work.
      c. For exterior gypsum sheathing, panel shall be complete with all joint sealant, wall ties and/or connectors, flashings and face veneer.
      d. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Architect.
      e. Revise as necessary to secure the Architect's approval.
   2. The mock-up panels, when approved by the Architect, will be used as datum points for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.

D. Reference Standards:
   1. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board", except for more stringent requirements of manufacturer.
   2. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 – Product Requirements.

B. Acceptance at Site
   1. Deliver material to site promptly without undue exposure to weather.
   2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

C. Storage and Protection
   1. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.
   2. Store above ground in dry, ventilated space.
   3. Broken, or damaged gypsum board will be rejected, whether built-in or not.

1.07 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
2. Do not begin installation of gypsum board until building is completely enclosed and protected from water infiltration.
3. Do not install gypsum board when ambient temperature is below 40ºF.
4. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55ºF from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.
5. Maintain illumination as required for proper installation of material.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.

2.02 METAL FRAMING MATERIALS

A. Structural and Non-Structural Steel Framing for Application of Gypsum Board: As specified in Section 05 4000.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   3. National Gypsum Company: www.nationalgypsum.com/#sle.
   4. USG Corporation: www.usg.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application:
      a. Non-fire rated partitions and ceilings: Type X.
      b. Fire rated partitions: Type X.
      c. Fire rated ceilings: Type C.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   3. Paper-Faced Products:
      a. CertainTeed Corporation; Type X and C Drywall: www.certainteed.com/#sle.
      b. Georgia-Pacific Gypsum; ToughRock Fireguard X and C: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond BRAND Fire-Shield Type X and C Gypsum Board: www.nationalgypsum.com/#sle.
      d. USG Corporation; USG Sheetrock Brand Firecode X and C Panels: www.usg.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Backing Board For Wet Areas:

1. Application: Surfaces behind tile and in wet areas including tub and shower surrounds, shower ceilings, and typical wall drywall base as detailed on the drawings.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
   b. Products:
      1) CertainTeed Corporation; GlasRoc 5/8" Type X Tile Backer: www.certainteed.com/#sle.
      2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
      3) National Gypsum Company; Gold Bond eXP Tile Backer: www.nationalgypsum.com/#sle.
      4) Substitutions: See Section 01 6000 - Product Requirements.

D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
   4. Core Type: Type X, as indicated.
   5. Type X Thickness: 5/8 inch.
   6. Edges: Square.
   7. Glass Mat Faced Products:
      a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com/#sle.
      b. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com/#sle.
      d. USG Corporation; USG Securock Brand Ultralight Glass-Mat Sheathing Firecode X: www.usg.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 2100.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. Splayed Corner Beads: All other than 90 degree outside corner.
   3. Architectural Reveal Beads:
      a. Shapes: As indicated on drawings.
   4. Expansion Joints:
      a. Type: V-shaped metal with factory-installed protective tape.
   5. Adjustable Partition Closure between storefront and drywall: Gordon Interior Specialties; Mullion Mate. Provide insulation and gaskets. Size to match application. Finish to match storefront.
   6. Other trims and reveals where shown on the drawings.

E. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch length, applied to bottom edge of gypsum board.

1. Provide 1/2”Tall Extruded PVC Moisture Guard: installed continuously at floor level of all gypsum drywall throughout building.
2. On all 2-Hour Rated walls and once the wall assembly is constructed, place a bead of sealant (latex, acrylic, silicone, polymer, or similar materials – not necessarily listed “fire caulk”) at floor level against the outer most layer of moisture guard on each side of the wall.
3. Height: 1/2 inch.
4. Depth: 5/8 inch.
5. Products:
   a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners at glass mat faced board assemblies.
2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Joint Compound: Drying type, ready-mixed.

G. Finishing Compound: Surface coat and primer, takes the place of skim coating.

H. Textured Finish Materials: Latex- or Vinyl-based compound; plain.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

K. For exterior applications provide bugle or wafer head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and as specified in Section 05 4000-Cold-Formed Metal Framing.

B. Blocking: Install supplementary framing, blocking and bracing for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Heavy trim, furnishings or similar construction.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION - GENERAL

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Wall Tile shall be installed on Concrete Unit Masonry or Glass Mat Faced Tile Backer Board in toilet/shower rooms, around water fountains or other areas in which the tile might be exposed to moisture. If CMU is not provided in these areas, Glass Mat Faced Tile Backer Board shall be used. Wall tile to be installed on Glass Mat Faced Tile Backer Board where located in corridors.

C. FRP shall be installed on Glass Mat Faced Tile Backer Board in toilet rooms, janitor closets, around water fountains or other areas in which the tile might be exposed to moisture.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Exterior Sheathing: Comply with GA-253 and ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.
   2. Attach exterior sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field. Do not counter sink.
   3. Locate fasteners minimum 3/8" from edges and ends of sheathing panels, tight against and flush with surface of sheathing.
   4. Immediately after installation, protect from weather by application of water-resistive barrier.

G. Installation on Metal Framing: Use screws for attachment of gypsum board.

H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 BOARD INSTALLATION

A. Single Layer Gypsum Board on Metal Studs .
   1. Loosely butt gypsum board joints together and neatly fit.
   2. Do not place butt ends against tapered edges.
   3. Maximum allowable gap at end joints: 1/8 inch.
   4. Stagger joints on opposite sides of partitions.
   5. Apply ceiling boards first where gypsum board ceilings and wall occur.
   6. Cut openings in gypsum board to fit electrical outlets, plumbing, light fixtures and piping snugly and small enough to be covered by plates and escutcheons. Cut both face and back paper.
   7. Screw board in place securely with screws spaced according to manufacturer's recommendations.
   8. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
   9. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.
   10. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
   11. In all installations, gypsum wallboard shall be held above the finished floor a minimum of ½”. Failure to comply with this requirement will be grounds for rejection and removal of the entire application.

B. Single Layer Gypsum Board on Furring
   1. Apply gypsum board with long dimension at right angles to furring channel.

2. Center end joints over channel web; stagger end joints from those in adjacent rows of board.
3. Fasten boards to furring channels with screws spaced according to manufacturer's recommendations.

C. Double Layer Gypsum Board
1. Fasten base layer to studs or furring with screws, and attach face layer using laminating adhesive and screws, applied according to manufacturer's instructions.
2. Offset face-layer joints at least 10 inches from parallel base-layer joints.
3. Screw both layers to metal supports at double layer ceiling applications and where required for fire-rated construction.

D. Single Layer Gypsum Board Suspended for Ceilings:
1. Install the gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.
2. Wallboard may be installed with the long dimension parallel to supporting members that are spaced 16" on centers when attachment members are provided at end joints.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints
1. Install control joints at junction of gypsum board partitions with walls or partitions of other finish material.
2. Install control joints within long runs of partitions at approximately 30'-0" on center or as indicated on the drawing.
3. Install control joints at bulkheads as shown on the drawings but in no case shall they exceed 15”-0” on center or as indicated on the drawing. Contractor shall be responsible to insure that bulkheads comply with this requirement and shall coordinate locations with the architect if not shown on the drawings.
4. Where gypsum board is vertically continuous, as at stairwells, provide horizontal control joints at each floor level.
5. Special Trim: Install as indicated on Drawings and in accordance with manufacturer's instructions.
6. Install control joints at each door jamb from head of door ceiling as shown on the drawings.
7. Do not install control joints behind any applied wall coverings.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Install metal casing bead trim whenever edge of gypsum board would otherwise be exposed or semi-exposed.

E. Special Trim and Reveal Joints: Install as indicated on Drawings and in accordance with manufacturer's instructions.

F. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in GA-214 , ASTM C840, and as follows:
1. Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
2. Level 2: Gypsum board substrate at tile, except remove tool marks and ridges.
3. Level 3: Gypsum board surfaces, where textured finishes will be used.

4. Level 4: Gypsum board surfaces scheduled to receive non-textured painted finishes, vinyl wall covering or custom covering is to be applied, except where another finish level is indicated.
5. Level 5: Gypsum board surfaces scheduled to receive painted graphics or Dry-Erase Coating.

B. General:
1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.
2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have dried.
3. Apply the joint treatment and finishing compound by machine or hand tool.
4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.
5. Joint Treatment is required at all gypsum board walls including fire protection assemblies above the ceiling line.

C. Embedding compounds:
1. Apply to gypsum wallboard joints and fastener heads in a thin uniform layer.
2. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged.
4. Sandpaper between coats as required.
5. When thoroughly dry, sandpaper to eliminate ridges and high points.

3.08 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.

B. Texture Required: Unless shown or otherwise indicated on the drawings, provide medium “Orange Peel or Spatter Finish” texture on walls or ceilings.

3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 2226
SUSPENSION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

B. Section Includes, but is not limited to:
   1. Metal suspension systems.
   2. Trim and accessories.

C. Related Sections:
   1. Section 05 4000 – Cold-Formed Metal Framing
   2. Section 09 2982 – Gypsum Board
   3. Section 09 5100 – Acoustical Ceilings
   4. Section 09 9000 – Painting and Coating

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A635 - Standard Specification for Sheet Steel.
   2. A641 - Standard Specification for Zinc-Coated Carbon Steel Wire
   3. C754 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
   4. C1002 - Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
   5. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials

B. Association References:
   1. Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board”
   2. Comply with "Specifications for Metal Lathing and Furring" published by the Metal Lath/Steel Framing Association.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
   1. Interior suspended ceilings and soffits: Maximum deflection of 1/360 of distance between supports.
   2. Exterior soffits: Withstand minimum positive and negative pressure of 20 psf with maximum deflection of 1/360 of distance between supports.
   3. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

1.04 SUBMITTALS

A. Product Data: Submit product data sheets on the following materials. Data sheets shall be marked to indicate the product and sizes used.
   1. Metal Framing and Furring Materials

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Single Source Responsibility:
      a. Obtain metal framing from a single manufacturer.

B. Reference Standards:

1. Applicable requirements of ASTM C754 for installation of steel framing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 – Product Requirements.

B. Acceptance at Site
   1. Deliver material to site promptly without undue exposure to weather.
   2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

C. Storage and Protection
   1. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.
   2. Store above ground in dry, ventilated space.
   3. Protect materials from soiling, rusting and damage.

1.07 PROJECT CONDITIONS

A. Project Environmental Requirements
   1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
   2. Maintain illumination as required for proper installation of material.

1.08 WARRANTY

A. Comply with requirements of Section 01 7800 – Closeout Submittals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements indicated herein, provide products of one of the listed manufacturers.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CEILING AND SOFFIT SUPPORT MATERIALS

A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or by certified test data.

B. Hangers
   1. Grade: Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceiling or soffit area and loads to be supported.
      a. Wire: ASTM A 641, soft, Class 1 galvanized.
      b. Rods and flats: Mild steel components.
   2. Finish: Galvanized or painted with rust-inhibitive paint for interior Work; galvanized for exterior Work.

C. Framing System
   1. Grade: Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635.
   2. Finish: Exposed surfaces finished in manufacturer’s standard enamel paint finish.
   3. Fire Rating: Rating in accordance with U.L. assembly as indicated on the drawings.
   4. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
      a. Main Tees: Heavy Duty classification 1-1/2” high x 144” long, integral reversible splice with knurled face. (Fire rated where required).

b. Cross Members: Members with knurled face. Cross Tees: 1-1/2” high x 48” long with 1-1/2” wide face; quick release cross tee ends for positive locking and removability without tools. (Fire rated where required).
c. Accessory Cross Tees: Cross tees must have knurled faces and quick release cross tee ends for positive locking and removability without tools.

5. Accessories:
a. U-shaped perimeter channel molding.
b. Galvanized carbon steel (12 ga.) hanger wire.

D. Hanger Wire Sound Isolators: Provide where indicated for sound-rated suspended ceilings.

E. Miscellaneous Accessories: Provide as required for complete installations.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with reference standards and manufacturer's instructions.

B. Tolerances:
1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
3. Shim as required to comply with specified tolerances.

C. Install framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

3.02 EXAMINATION

A. Site Verification of Conditions:
1. Examine substrates and adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. Comply with provisions of Section 01 7000 – Execution and Closeout Requirements.

3.04 METAL SUPPORT INSTALLATION

A. Ceiling Support Systems
1. Secure hangers or rods to structural support by connecting directly to structure where possible; otherwise connect to inserts, clips or other anchorage devices or fasteners indicated.
2. Space main runners, hangers and furring according to requirements of ASTM C754, except as otherwise indicated.
3. Where spacing of structural members, or width of ducts or other equipment, prevents regular spacing of hangers, provide supplemental hangers and suspension members and reinforce nearest affected hangers to span extra distance.
4. Attach directly to structural elements only, do not attach to metal deck. Loop hangers and wire-tie directly or provide anchors or inserts.

3.05 ADJUSTING

A. Correct damage and defects which may telegraph through finished work.

B. Leave Work smooth and uniform.

3.06 CLEANING

A. Comply with requirements of Section 01 7000 – Execution and Closeout Requirements.

B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Trim and accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry.

B. Section 05 4000 - Cold-Formed Metal Framing.

C. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

D. Section 07 9513 - Expansion Joint Cover Assemblies: Expansion joint components.

E. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 12 by 12 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Grout: Submit manufacturer's full range of standard and designated color samples for each type of grout for Architect's selection.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: At completion of project, deliver to Owner extra stock of materials used on project as follows:
      a. Two (2) cartons of each color of floor tile.
      b. Two (2) cartons of each color of wall tile.
      c. Thirty (30) lineal feet of each color and type of base.
   3. Store in location as directed by Owner.

4. Ensure materials are boxed and identified by manufacturer, type, and color.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications:
   1. Tile: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
   2. Setting Materials: Minimum ten years experience in manufacturing the types of setting and grout materials specified.
   3. Membrane: Minimum five years experience in manufacturing the types of membrane materials specified.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where determined by the Architect, incorporating all components specified for the location.
   1. Minimum size of mock-up is full height of wall, 6'-0" long or as determined by the Architect to incorporate all components. More that one mock-up may be required to demonstrate all materials in the project.
   2. Mock-up shall be approved by the Architect or Architect's representative. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of no less than 50 degrees F and no more than 100 degrees F during installation of mortar materials.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace tile that fails in materials or workmanship within the specified warranty period.
   1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Arizona Tile: www.arizonatile.com.
   3. Concept Surfaces: www.conceptsurfaces.com.
   4. Crossville Inc.: www.crossvilleinc.com.
   5. Dal-Tile Corporation: www.daltile.com/#sle.
   6. Emser Tile, LLC: www.emser.com/#sle.
   7. Horizon Italian Tile: www.horizontile.com.
   8. Pantheon: pantheontile.com.
   9. Substitutions: See Section 01 6000 - Product Requirements.

B. Ceramic Tile: ANSI A137.1, standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.

2. Size: As scheduled.
3. Edges: Square.
4. Surface Finish: Matte glaze.
5. Product and Color(s): Refer to Section 01 6210 - Schedule of Materials and Colors.
6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes indicated.

C. Quarry Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
2. Size: As scheduled.
3. Thickness: 1/2 inch, nominal.
4. Edges: Square.
5. Surface Finish: Matte glazed.
6. Provide 3/16" grout joints at quarry tile locations.
7. Product and Color(s): Refer to Section 01 6210 - Schedule of Materials and Colors.
8. Trim Units: Matching bullnose, cove, cove base, and window sill or step nosing shapes in sizes indicated.

D. Porcelain Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: As scheduled.
3. Thickness: 3/8 inch.
4. Edges: Square.
5. Surface Finish: Matte glazed.
6. Product and Color(s): Refer to Section 01 6210 - Schedule of Materials and Colors.
7. Trim Units: Matching bullnose, double bullnose, cove base, cove, and window sill or step nosing shapes in sizes indicated.
8. Provide Large Format Tile mortar as required according to manufacturer's recommendation.

2.02 TRIM AND ACCESSORIES

A. Trim: Matching bullnose, cove base, and window sill or step nosing shapes in sizes coordinated with field tile.
1. Applications:
a. Open Edges: Bullnose.
b. Inside Corners: Jointed.
c. Floor to Wall Joints: Cove base.
2. Manufacturers: Same as for tile.

B. Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
a. Wall corners, outside.
1) Roll formed 304 (1.4301 = V2A) (EB) brushed stainless steel, perforated anchoring leg, square outer corner with 1/4" radius along the surface edge.
2) Equal to Schluter - QUADEC.
3) Size: As required for tile.
4) Accessories:
(a) Outside Corner Endcap
(b) Connector (stainless steel)
b. Wall edges, top.
1) L-shaped profile with 1/8" wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2) Material and Finish: EB - Brushed Stainless Steel Type 304 = V2A.

3) Equal to Schluter - SCHIENE.
4) Size: As required for tile.
5) Accessories:
(a) Outside Corner Endcap
(b) Connector (stainless steel)

c. Floor to wall joints when coved base is not availible.
1) Roll formed 304 (1.4301 = V2A) (EB) brushed stainless steel profile with integrated trapezoid-perforated anchoring legs, connected at a 90 degree angle by a core-shaped section with 3/8 inch radius that forms the visible surface.
2) Equal to Schluter DILEX-EHK.
3) Size: As required for tile.
4) Accessories:
(a) Outside Corner (90 degrees)
(b) Inside Corner, 2-way (90 degrees)
(c) Connector
(d) End Cap

d. Borders and other trim as indicated on drawings.

2. Manufacturers:
a. Schluter-Systems: www.schluter.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

C. Thresholds: Marble, solid surface or other material as indicated on the drawings; color as selected, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled on long edge with radiused corners on top side; without holes, cracks, or open seams.

2.03 SETTING MATERIALS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. Bostik Inc: www.bostik-us.com.
3. Custom Building Products: www.custombuildingproducts.com.
4. LATICRETE International, Inc: www.laticrete.com.
5. Mapei Corporation: www.mapei.com.
6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide setting materials made by the same manufacturer as grout.

C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated and in thick-set applications.

D. Organic Adhesive: ANSI A136.1, thinset mastic type.
1. Applications: Use for shower floors and walls.
2. Use Type I in areas subject to prolonged moisture exposure.

E. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
1. Applications: Use in thin-set applications.

F. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

2.04 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. Bostik Inc: www.bostik-us.com.
3. Custom Building Products: www.custombuildingproducts.com.
4. LATICRETE International, Inc: www.laticrete.com.

5. Mapei Corporation: www.mapei.com
6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As selected by Architect from manufacturer's full line.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Provide at all food preparation areas.
2. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
a. ARDEX Engineered Cements: www.ardexamericas.com.
b. Custom Building Products: www.custombuildingproducts.com.
c. LATICRETE International, Inc: www.laticrete.com.
d. Mapei Corporation: www.mapei.com
e. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new portland cement grout.
1. Composition: Water-based penetrating sealer.
2. Products: As recommended by the grout manufacturer.

2.06 ACCESSORY MATERIALS

A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Fluid or Trowel Applied Type:
a. Apply under all tile floors, and all floor penetrations including but not limited to floor drains and pipe penetrations as well as floor to wall intersections. Provide backer rod at floor to wall intersections and continue membrane 12" minimum up wall surface.
b. Thickness: 25 mils, minimum, dry film thickness.
c. Products:
1) Basis of Design: Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com; or products of one of the following manufactures:
2) ARDEX Engineered Cements: www.ardexamericas.com/#sle.
3) H.B. Fuller Construction Products Inc: www.tecspecialty.com/#sle.
4) LATICRETE International, Inc: www.laticrete.com/#sle.
5) Mapei Corporation: www.mapei.com
6) Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
7) Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

C. Deep Cleaning of Existing Tile; where noted on the drawings.

1. Where tile or stone surfaces are scheduled to be "Deep Cleaned", provide a high-alkaline, two part industrial strength cleaner and degreaser for heavily soiled and neglected areas.
2. Products:
   a. Custom Building Products; Aqua Mix 1 & 2 Deep Clean: www.custombuildingproducts.com
   b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

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 tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
   2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Where wall or floor tile extends across EJ or CJ provide a 3/8" wide joint to align with the EJ or CJ and fill with sealant to match grout. All joints shall comply with the requirement set in the TCNA Handbook, EJ171 Movement Joint Guidelines for Ceramic, Glass and Stone.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

N. At changes in plane, inside corners and tile-to-tile control joints, use sanded tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.

B. Waterproofing Membrane: Install as recommended by manufacturer .

C. Mortar Bed Thickness: 2 inch, unless otherwise indicated.

3.06 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B420, mortar bed floor, and W245, thin-set over coated glass mat backer board walls.

B. Grout with latex-Portland cement grout.

3.07 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
   1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
   2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.

C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.08 CLEANING

A. Clean tile and grout surfaces.

3.09 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

3.10 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Decorative Grid System Trim

C. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking: Placement of special anchors or inserts for suspension system.

B. Section 07 2100 - Thermal Insulation: Acoustical insulation.

C. Section 08 3100 - Access Doors and Panels: Access panels.

1.03 REFERENCE STANDARDS

A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

B. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2017.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

D. CISCA (AC) - Acoustical Ceilings: Use and Practice; 1999.

E. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's certificate that products meet or exceed specified requirements.

H. Material Safety Data Sheets under provisions of Section 01 7800 - Closeout Submittals for the following items:
   1. All mastics, glues, and adhesives
   2. Acoustical ceiling tile

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications: An entity experienced in the installation of acoustical ceiling systems similar to requirements for this Project, and acceptable to, or licensed by, acoustical ceiling systems manufacturer.

E. Comply with the following standards:
1. CISCA (AC) "Acoustical Ceilings: Use and Practice."
2. CISCA (AC) "Guidelines for Seismic Restraint Direct Hung Suspended Ceiling Assemblies."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.

B. Deliver acoustical ceiling system components in manufacturer's original unopened packages or containers, with labels intact.

C. Store all components to provide suitable protection against deleterious effects from exposure to moisture, direct sunlight, or other causes.

D. Handle all components to preclude damage. Take special precaution to prevent damage to acoustical ceiling unit edges and corners.

E. Comply with manufacturer's Material Safety Data Sheets (MSDS) for delivery, storage, and handling of components.

1.08 FIELD CONDITIONS

A. Maintain uniform temperature of 60 - 85 degrees F, and maximum relative humidity of 70 percent prior to, during, and after acoustical unit installation.

B. Prior to installation, the following conditions must exist:
1. All windows and exterior doors in place and roof watertight.
2. Work of all wet trades completed and thoroughly dried to installation of any system components.
3. Mechanical and Electrical trades shall have completed their work above ceiling line prior to acoustical ceiling systems installation. Coordinate with Mechanical and Electrical trades prior to start of installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. The manufacturer shall provide a minimum 15-year acoustical ceiling and suspension system warranty. Warranty shall warrant against ceiling tile sagging, warping and suspension grid rusting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
1. Armstrong World Industries, Inc: www.armstrongceilings.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Rockfon, LLC: www.rockfon.com/#sle.

4. USG: www.usg.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
1. Same as for acoustical units.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Tile Type L1 - Standard Panel: Painted mineral fiber, ASTM E 1264 Type III, Form 2, Sag Resistant Panels with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 3/4 inches.
3. Composition: Water felted.
4. Light Reflectance: Not less than 0.82 percent, determined in accordance with ASTM E1264.
5. NRC Range: Not less than 0.70, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
7. Edge: Square.
8. Surface Color: White.
9. Surface Pattern: CE (perforated, small holes and lightly textured)..
10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
11. Products:
    a. Basis of Design: School Zone Fine Fissured 1713 as manufactured by Armstrong World Industries
    b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Tile Type L2 - Impact Resistant Panel: Painted mineral fiber, ASTM E 1264 Type III, Form 2, Sag Resistant Panels with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 3/4 inches.
3. Composition: Water felted.
4. Light Reflectance: Not less than 0.87 percent, determined in accordance with ASTM E1264.
5. NRC Range: Not less than 0.50, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): Not less than 33, determined in accordance with ASTM E1264.
7. Edge: Square.
8. Surface Color: White.
9. Surface Pattern: CE (perforated, small holes and coarse textured).
10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
11. Provide Impact Retention Clip System as per manufacturers specifications.
12. Products:
    a. Basis of Design: Armatuff 861 as manufactured by Armstrong World Industries
    b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
    c. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Tile Type L4 - Foodservice Panel: Painted mineral fiber, ASTM E 1264 Type IX Form 2, Sag Resistant Panels with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Water felted.
   4. Light Reflectance: Not less than 0.89 percent, determined in accordance with ASTM E1264.
   5. Ceiling Attenuation Class (CAC): Not less than 33, determined in accordance with ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Surface Pattern: G (smooth texture).
   9. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
   10. Products:
      a. Basis of Design: Kitchen Zone 673 as manufactured by Armstrong World Industries
      b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
         1) Vinyl faced, gypsum core products are acceptable.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Acoustical Tile Type L5 - Acoustical “Reflective” Panel: Painted mineral fiber, ASTM E 1264 Type III, Form 2, Sag Resistant Panels with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Water felted.
   4. Light Reflectance: Not less than 0.85 percent, determined in accordance with ASTM E1264.
   5. NRC Range: Not less than 0.55, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): Not less than 33, determined in accordance with ASTM E1264.
   7. Edge: Square.
   8. Surface Color: White.
   9. Surface Pattern: CE (perforated, small holes and lightly textured)..
   10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
   11. Products:
      a. Basis of Design: Fine Fissured 1728 as manufactured by Armstrong World Industries
      b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Glass Fiber Acoustical Panels Type L6 – Acoustical “Absorptive” Panel: painted faced glass fiber, ASTM E 1264 Type XII, Form 2, Sag Resistant Panels with the following characteristics:
   1. Size: 24 by 48 inches.
   2. Thickness: 7/8 inches.
   3. Light Reflectance: Not less than 0.88 percent, determined in accordance with ASTM E1264.
   4. NRC Range: Not less than 0.90, determined as specified in ASTM E 1264.
   5. Articulation Class (AC): Not less than 190, determined in accordance with ASTM E1264.
   6. Edge: Kerfed.

7. Surface Color: White.
8. Surface Pattern: E (fine texture).
9. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
10. Products:
    a. Basis of Design: Optima Concealed 8538PB as manufactured by Armstrong World Industries
    b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
    c. Substitutions: See Section 01 6000 - Product Requirements.

F. Acoustical Tile Type L7 – Acoustical “Absorptive” Ceiling-General Use Panel: Painted mineral fiber, ASTM E 1264 Type IV, Form 2, Sag Resistant Panels with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 1 inches.
3. Composition: Water felted.
4. Light Reflectance: Not less than 0.86 percent, determined in accordance with ASTM E1264.
5. NRC Range: Not less than 0.85, determined in accordance with ASTM E1264.
6. Articulation Class (AC): Not less than 170, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
8. Edge: Square.
9. Surface Color: White.
10. Surface Pattern: E (lightly textured).
11. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
12. Products:
    a. Basis of Design: Calla 2820 as manufactured by Armstrong World Industries
    b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch wide face, main tee 1-1/2 inch, cross tee 1-1/2 inch.
2. Construction: Double web.
3. Finish: White painted.
4. Products:
    a. Basis of Design for Non-Fire Rated Assemblies – Ceiling Types I, II, V, VI, VII and IX: "Prelude XL Galvanized Capped" as manufactured by Armstrong World Industries
    b. Basis of Design for Non-Fire Rated Assemblies – Ceiling Types III, IV: "Prelude XL Aluminum Capped" as manufactured by Armstrong World Industries
    c. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01. Ceiling Tile and Grid shall be as approved by the manufacturer.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
   1. Angle Hangers: ASTM A 446 steel with G90 coating.
   2. Flat Hangers: Zinc-coated steel.
   3. Hanger Rods: Zinc-coated steel.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Decorative Grid System Trim
   1. Physical properties.
      a. Extruded aluminum alloy 6063 trim channel, 10' straight or curved profiles.
      b. Concealed connections to grid with T-bar connection clip, including all necessary trim for corners inside and outside and all accessories.
      c. Size: 8" wide face with 3/4" horizontal legs, straight or curved sections with special bosses formed for attachment to Axiom T-bar connection clip or hanging clip.
      d. Color: Match color of grid.
      e. Finish: Factory-applied baked polyester paint.
   2. Products:
      a. Basis of Design: Axiom, Classic Trim as manufactured by Armstrong World Industries.
      b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

E. Touch-up Paint: Type and color to match acoustical and grid units.

F. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with UL design requirements ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Main runners directly suspended by minimum 12 gage galvanized steel wire; hanger wire wrapped tightly a minimum three full turns.
   1. Runner Spacing: 4’-0”.
   2. Hanger Spacing: 4’-0”.

E. Main runners interconnected by cross-tees to form modules as shown on reflected ceiling plans. Suitable cross-tee lengths adjacent to recessed light fixtures on each side not supported by a main runner.

1. Cross-Tee Spacing: 4’-0”.

F. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

G. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.
2. Overlap and rivet corners.

L. Add extra ceiling wire at each corner of light fixtures and grilles.

M. Fire rated main runner/cross runner fire expansion relief cutout shall be evaluated for load performance where field application requires the expansion relief to be designed more than 3” from the closest support point.

N. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Install acoustical ceiling units from a three-carton mix to obtain uniform distribution of surface variations.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.

H. Sound walls: Set acoustical ceiling boards in four continuous beads of 1/4" diameter sealant, one at top of each edge of the gypsum drywall and two on top of the top metal runner track.

I. Install hold-down clips on each panel to retain panels tight to grid system at rated assemblies; comply with fire rating requirements.

3.04 ADJUSTMENTS

A. Make adjustments in ceiling system as necessary to ensure compliance with this specification.

B. Remove and replace damaged or soiled acoustical ceiling units.

3.05 CLEANING

A. Remove debris which may have been caused during installation of this work.

B. In addition to other stipulated requirements for cleaning, completely remove fingerprints and traces of soil from the surfaces of grid and acoustical materials, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

END OF SECTION

SECTION 09 6466
WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood Flooring for Gymnasiums

B. Wood Flooring for Dance Studios

1.02 RELATED REQUIREMENTS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 in these specifications.

B. Section 03 3000 – Cast-In-Place Concrete
   1. Concrete substrate flatness and leveling tolerances, curing, finishing, and vapor barrier.
   2. Slab Depression: Verify depression with final approved product.
   3. Tolerance: 1/8" in radius of 10' Surface-steel troweled.

C. Section 11 6623 – Gymnasium Equipment

1.03 REFERENCE STANDARDS

A. MFMA - Maple Flooring Manufacturers Association

B. DIN - Performance Standard DIN 18032, Part II

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product data: Provide manufacturer’s detailed technical product data and installation instructions for each type of wood flooring. Include instructions for handling, storage, installation, dimensions of individual components, profiles, edge detail, finishing, protection, and maintenance.

C. Samples: Submit sets of range samples for each type of wood flooring:
   1. Include finish samples of factory-finished flooring.
   2. Include samples of striping of different colors indicated.
   3. Accessories: Include minimum 6-inch-long samples of each type of required accessory item such as baseboard, and trim.

D. Shop drawings: Indicate layout and types of wood flooring, including plans, elevations, sections, details of anchorage and attachments to other units of work, and conditions requiring feature strips, reducer strips, baseboard, trim, molding, nosings, or other accessories.

E. Maintenance Literature
   1. Submit three (3) copies of "MFMA Care and Preservation of Your Wood Floors."

F. Certification
   1. Suppliers shall submit an Otto Graph Institute suitability report attesting that floor system has passed all DIN requirements under DIN 18032, Part II.
   2. Suppliers shall submit certificates attesting that materials furnished will meet specifications for grade, quality, and dryness.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Deliver extra material to Owner. Before installation begins, furnish not less than 1.0 percent of the quantity of each type wood flooring installed on the Project, packaged with protective covering for storage and identified with labels clearly describing contents.

1.05 QUALITY ASSURANCE

A. Floor System Manufacturer Qualifications

1. Manufacturer shall be an established firm experienced in field and have been in business for a minimum of ten years.
2. Manufacturer shall be a member in good standing of the Maple Flooring Manufacturers Association.

B. Floor Contractor/Installer Qualifications
1. Flooring Contractor/Installer shall be a firm experienced in flooring field and approved by manufacturer and have operated under the same corporate name for the last ten years.
2. The flooring contractor shall be an MFMA Mill Accredited Installation Company and also a accredited installer with the flooring manufacturer with MFMA Accredited Installer(s) on-site for the duration of the wood floor installation.
3. Flooring Contractor/Installer shall submit a list of at least ten completed jobs similar in size and specifications.

C. Performance Qualifications
1. Ten days prior to bid date a letter of compliance and a copy of the actual “Suitability Test Report” shall be provided by the manufacturer to the Architect to verify that the system meets and/or exceeds all of the DIN criteria set forth below. All testing must be done in accordance with DIN 18032, part II, area elastic gymnasium floor, Otto-Graf Institute, Stuttgart, Germany. Testing must be done by the Otto-Graf Institute or an independent testing laboratory complying with DIN 18032, Part II testing procedures. Also included in the letter of compliance is verification that maple lengths, (+/-6’6”) will be as specified. Flooring system shall have been tested and passed the requirements of DIN 18032, Part II as set out below:
   a. Shock Absorption: shall be 53% minimum.
   b. Ball Return: shall be at least 90%.
   c. Deflection: shall be 2.3mm minimum.
   d. Area Deflection: (Isolation of impact) less than 15.0%
   e. Friction: Pass (0.5 to 0.7)
   f. Rolling Load: Pass (337.6 lbs min.)
2. The manufacturer and installer will warranty the product jointly for a period of two years from the date of completion. An unsigned copy of the warranty must accompany the product samples before a contract for installation is issued.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials
1. Materials shall not be delivered, stored or installed until all masonry, painting, plastering, tilework, marble and terrazzo work are complete. All overhead mechanical work, lighting, backstops, scoreboards are installed prior to floor installation. Room temperature of at least 60 to 80 degrees Fahrenheit and relative humidity of 35 to 50% are to be maintained. Ideal installation/storage conditions are the same as those which will prevail when building is occupied.

1.07 FIELD CONDITIONS

A. Do not install floor system until concrete has been cured 60 days and the requirements are obtained.

B. Permanent heat, light and ventilation shall be installed and operating before, during and after installation. Maintaining a temperature range of 60 to 80 degrees Fahrenheit and a relative humidity range of 35 to 50%.

C. After floors are finished, area to be kept locked by General Contractor to allow curing time for the finish. If after required curing time, General Contractor or Owner requires use of the gym, he shall protect the floor by covering with non-fibred kraft paper or red rosin paper with taped joints, until acceptance by Architect of complete wood floor.

1.08 WARRANTY

A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.

B. The manufacturer shall hereby warrant the material to be free from manufacturing defects for a period of one (1) year. This warranty is in lieu of all other warranties, expressed or implied, including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligation on the part of the manufacturer. In the event of breach of any warranty, the liability of the manufacturer shall be limited to repairing or replacing the material and system components supplied by the manufacturer and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

C. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Connor Sports Flooring: www.connorfloor.com.

B. Robbins Sports Surfaces: www.robbinsfloor.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS – GYMNASIUMS

A. Membrane
   1. 6 mil polyethylene

B. Hardwood Flooring System equal to “ACS” Air-Channel Star System by Robbins, Anchored Rezill Sleeper (DIN) by Connor or Anchored Power Sleeper DIN by Aacer.
   1. Robbins 7/16" Bio-Cushion Pads
      a. Pads shall be double trapezoidal EPDM rubber with reverse cavity. Lower and upper surfaces shall be non-coextensive. Pads shall have full & immediate recovery.
   2. “ACS” sleepers having eight (8) 7/16” Bio-Pads properly spaced and stapled to the bottom and modified to accept anchors.
   3. Robbins “Posi-Anchor” anchoring pin.
   4. Plywood Sub-floor - 15/32” APA Rated Sheathing Exposure I.
   5. Fasteners
      a. Sub-flooring - 1-1/4” coated nails or staples.
      b. Flooring - 2” barbed cleat or equivalent.
   6. Flooring
      a. 25/32" x 2-1/4" 2nd & Btr Grade Northern Hard Maple flooring, R/L, KD, TG, & EM MFMA grade marked and stamped as manufactured by Robbins, Connor or Aacer Flooring in accordance with the MFMA grading rules and standards. Court shall be 2nd & Btr Grade. Remainder of floor shall be 3rd Grade.

2.03 MATERIALS – DANCE STUDIO

A. Membrane 6-mil polyethylene.

B. 3/4" Bio-Pads shall be EPDM Rubber with a durometer of 50, Connor 3/4" Black Neo-shok, and Aacer 3/4" Blue Tri-Power Pad.

C. Plywood underlayment – 2 layers 1/2” (15/32”) x 48” x 96” APA Rated Sheathing, Exposure 1, minimum 4 ply, Fir or Southern Pine.

D. Nails – 1” coated staples or equivalent for sub-floor, 2" barbed cleat for flooring.

E. Adhesives:

1. Construction adhesive - PL400 or equal to glue plywood sheets together.

F. Flooring: 25/32 " x 2-1/4" 2nd & Btr Grade Northern Hard Maple flooring, R/L, KD, TG, & EM MFMA grade marked and stamped as manufactured by Robbins, Connor, or Aacer Flooring in accordance with the MFMA grading rules and standards.

2.04 FINISHING

A. Materials:
1. 1st/2nd Coat: Hillyard's Trophy Seal
2. Court Striping:Hillyard's Gym Marking Paint
3. 3rd/4th Coat:Hillyard's Trophy Seal

B. Game line paint shall be as recommended by the finishing materials manufacturer, compatible with the finish system.

C. After proper sanding, floors must be completely free from sanding dust and perfectly clean. Apply one liberal coat tack sealer. Screen or steel wool and vacuum and/or tack between each coat after it dries. Clean floor. For gym floors, mark game lines in accordance with drawings and UIL Standards. Let dry 24 hours. For dance studios, after applying sealer, buff in order to provide a low gloss, flat finish.

D. Painted Graphics:
1. All painted graphics shown on the drawings shall be included in the base proposal and shall be included in this section.
2. Contractor shall note that school colors and mascot may be released after initial color selection. Contractor shall make all necessary adjustments.

2.05 OTHER MATERIALS

A. Perimeter Base Molding – 3” x 4” rubber ventilating type. Provide factory preformed exterior corners and job mitered interior corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect concrete sub-floors for proper tolerance and dryness, and report any discrepancies to the general contractor.

B. All work required to put the concrete sub-floors in acceptable condition shall be the responsibility of the general contractor.

C. Sub-floor should be broom cleaned by general contractor.

3.02 INSTALLATION

A. Hardwood Flooring System – Gymnasium
1. Install polyethylene with joints lapped a minimum of 6".
2. Install ACS-Sleepers end to end at right angles to finished flooring spaced 16” O.C.
3. Properly anchor ACS-Sleepers using Robbins Posi-Anchors. Maintain a 2” minimum expansion void at all walls and other permanent obstructions.
4. Install plywood sub-floor with long dimension perpendicular to finish flooring staggering joints 24” in adjacent rows and spacing 1/4”. Securely nail plywood sub-floor to ACS-Sleepers.
5. Machine nail maple finish flooring at right angles to ACS-Sleepers and provide proper spacing for humidity conditions in the specific regions. Provide 2" expansion void at the perimeter.

B. Robbins Bio Cushion Classic – Dance Studio
1. Install polyethylene film with joints lapped a minimum of 6”.

2. Install Robbins resilient Bio-Pads to bottom of first layer of sub-floor, 32 pads per panel or 12" on centers. Panels shall be laid perpendicular to finish flooring. (Optional laid at 45 degree angle). Allow 1/4" spacing on all sides of abutted panels and stagger joints 4'.
3. Install second layer of plywood laid diagonally at 45 degree angles over the first layer with 1/4" spacing on all edges and breaking rows at 4'. Second layer shall be attached by applying ribbons of adhesive in a box - X pattern and using 1" - 1-1/4" coated nails or staples at a minimum of 12" on center. If laying first layers at 45 degree angle, lay second layer at opposite 45 degree angle. Provide a 1-1/2-2" expansion voids at perimeter and all vertical obstructions.
4. Machine nail maple finish flooring at right angles to ACS-Sleepers and provide proper spacing for humidity conditions in the specific regions. Provide 2" expansion void at the perimeter.

C. Sanding
1. Sand flooring with drum sander, edger, buffer, and hand scraper.
2. Use coarse, medium and fine grade sandpaper.
   a. After sanding with drum sander, buff entire floor using 100 grit screenback or equal grit sandpaper, with a heavy-duty buffing machine.
   b. Vacuum or tack floor before first coat of finish.
   c. Floor shall present a smooth surface without drum stop marks, gouges, streaks or shiners.

D. Finishing
1. Apply two (2) coats of approved seal and two (2) coats of approved finish per manufacture’s instructions.
2. Buff and clean floor between coats.
3. Games Lines: Apply game lines as indicated on drawings, between seal and first coat of finish.

E. Perimeter Base Molding
1. Install vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corners.

F. Clean up all unused materials and debris and remove same from the premises.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
1. All mastics, glues, and adhesives

C. See Section 01 7900 - Demonstration and Training, for additional requirements.

D. Demonstration: Demonstrate maintenance of flooring to Owner's personnel.
1. Instruction and maintenance shall be performed by the flooring subcontractor and a representative of the flooring manufacturer. Refer to Section 01 7800, Closeout Documents for additional requirements and information.
2. The demonstration shall include written guidelines for the proper equipment, operation, materials and manufacturers recommended schedule of maintenance.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, 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, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

D. Concrete Testing Standard: Submit a copy of ASTM F710.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor 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. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 5% of each type and color.
   3. Extra Wall Base: 5% of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 5% of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.

1.06 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 and 90 degrees F.

D. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Maintain temperature in storage area between 65 degrees F and 85 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace flooring that fails in materials or workmanship within the specified warranty period.
   1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com.
      b. Flexco, Inc: www.flexcofloors.com.
      c. Johnsonite, a Tarkett Company: www.johnsonite.com.
      d. Roppe Corp: www.roppe.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or ASTM E 648.
   3. Height: 4 inch.
   4. Thickness: 0.125 inch.
   5. Length: Roll.
   6. Color: Refer to Section 01 6210 Schedule of Materials and Colors.
   7. Accessories: Premolded external corners where return is 3" or less.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Adhesives
   1. Provide only high moisture and alkali tolerant type adhesive as recommended by the manufacturer of the material being installed.
   2. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.
   3. Contact manufacturer for recommended adhesive if pH levels exceed 9 or MVER exceeds 5 pounds.

C. Where the moisture-vapor-emission rate exceeds the manufacturers allowable rate provide and install a moisture mitigating primer as reccommended by the manufacturer.

D. Moldings, Transition and Edge Strips: Metal.

PART 3 EXECUTION

3.01 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 resilient base.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Clean substrate.

C. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's written instructions.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At returns of 3" or less, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

E. Provide continuous sealant at top of base in all Foodservice areas inluding kitchens, food storage, serving lines, etc. Color as selected by Architect.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

C. If it becomes necessary to move any heavy fixtures or appliances over the flooring on casters or dollies, the flooring should be protected with 1/4" or thicker plywood, hardboard or other underlayment panels. If other on-site work is continuing, use a protective covering such as plain, undyed kraft paper to guard against damage to the new floor.

END OF SECTION

SECTION 09 6816
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.

C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.

D. Samples: Submit three samples 12 by 12 inch in size illustrating color and pattern for each carpet material specified.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional requirements.
   2. Extra Carpet: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum five years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace tile that fails in materials or workmanship within the specified warranty period.
   1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carpet:
   1. Tandus Centiva: www.tandus-centiva.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CARPET

A. Carpet:
   1. Product: _____ manufactured by _____.
   2. Roll Width: ____ ft.
   3. Color: Refer to Section 01 6210 Schedule of Colors for approved color selection..
   4. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Edge Strips: Vinyl, color as selected.
   1. Product: Burke Flooring; Tile and Carpet Joiner No. 150: www.burkemercer.com.

C. Adhesives:
   1. Provide only high moisture and alkali tolerant type adhesive as recommended by the manufacturer of the material being installed.
   2. Contact manufacturer for recommended adhesive if pH levels exceed 9 or MVER exceeds 5 pounds.
   3. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Install carpet and cushion in accordance with manufacturer's instructionsand CRI 104 (Commercial).

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

D. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

C. Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of traffic, maintaining intact until carpeted space is accepted by the Owner.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 09 7223
CUSTOM DIGITAL WALL COVERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom Digital Wall Covering.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry

B. Section 09 2982 - Gypsum Board

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Samples and strike-offs shall be sent to the Architect/Designer and Owner for final approval.

E. No product shall be fabricated or installed without signature and approval of the Owner.

F. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention. All special instructions shall be provided by the Manufacturer to the Contractor.

H. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Provide final digital print files, shop drawings and product data for Owner's use.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

C. Applicator Qualifications: Work of this section shall be performed by a firm regularly engaged in the installation of environmental graphics of the types and qualities specified, coordinated by Manufacturer/Contractor, and acceptable to the Architect/Designer.

D. Field verifications/dimensions shall be sent to the General Contractor and coordinated with the Installer and Manufacturer before any artwork is to be printed or executed. Graphics company shall coordinate a trip with the contractor to the site to pre-measure walls prior to the release of any material.

E. Color match on graphic prints may have some slight variability due to printer and monitor calibration.

1.06 MOCK-UP

A. Locate where directed.

B. Mock-up may remain as part of the Work.

C. Architect/Designer may provide additional drawings to clarify design intent if required.

1.07 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.

1.08 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.

PART 2 PRODUCTS

2.01 CUSTOM DIGITAL WALL COVERING

A. Custom Digital Wall Covering:
   1. Digital wall covering shall be certified 20 oz. (457g/m2) Type II, Class "A" vinyl for solvent, eco-solvent, UV curable and latex inks.
      a. Basis of Design: See Section 01 6210 - Schedule of Materials and Colors for product selection.
      b. Manufacturers:
         1) Building Image Group: www.buildingimagegroup.com
         2) MDC Wallcoverings: www.mdcwall.com.
         3) Reprographic Consultants: www.reprocon.com
         4) Riot Creative Imaging: www.riotcolor.com
         5) Tri-Kes/Source One: www.tri-kes.com.
         6) Waterboy Graphics: www.waterboygraphics.com
         7) Substitutions: See Section 01 6000 - Product Requirements.
   2. Physical Properties
      a. Width: 54" or 60"
      b. Product Weight: 20 oz. per lineal yd. (13oz. per sq. yd.)
      c. Vinyl Weight: 17 oz. per lineal yd.
      d. Fabric Weight: 3 oz. per lineal yd.
      e. Thickness: 0.017 to 0.027 depending on texture
      f. Fabric: Woven Poly Cotton Osnaburg
   3. Tensile Strengths
      a. Warp - Exceeds Type II minimum of 50 lbs.
      b. Fill - Exceeds Type II minimum of 55 lbs.
   4. Tear Strengths
      a. Warp - Exceeds Type II minimum of 25 lbs.
      b. Fill - Exceeds Type II minimum of 25 lbs.
   5. Fire Testing
      a. Meets or exceeds requirements for flame spread, smoke developments and flashover
      b. ASTM-E84 Tunnel Test: Class A
      c. NFPA286 Corner Burn Test: Class A
      d. NFPA265 Corner Burn Test: Class A
   6. Mold/Mildew/Bacterial Resistance

a. ASTM-G21: Passed all requirements of CCCW-408-D

7. Color Mode and Image Resolution: All images and files shall be submitted and printed in CMYK color mode. Image resolution for offset and digital print shall be 300 DPI at final size. Image resolution for wide format print shall be minimum 125 DPI at final size.
8. All vinyl wall coverings located on exterior walls shall be micro-perforated for permeability.

B. Accessories
1. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
2. Termination Trim: Extruded plastic, color as selected.
3. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
4. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work, and conform to requirements of the graphics 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 nor vary at a rate greater than 1/16 inch/ft.

D. Upon discovery of unacceptable conditions, including but not limited to, finish level, light swithces, outlet covers, supply/return grills and any other obstructions within the graphic area, the installer will notify the client and Architect/Designer and not proceed until the conditions are acceptable. Starting installation constitutes acceptance of surface conditions.

3.02 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.

3.03 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. Let contact adhesive set tack free.

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. Butt edges tightly.

F. Horizontal seams are not acceptable.

G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

I. Do not install wall covering more than 1/4 inch below top of resilient base.

J. Cover spaces above and below windows, above doors, in pattern sequence from roll.

K. Before cutting, field install to layout environmental design elements in accordance with submittal drawings and any additional design intent drawings provided by Architect/Designer for installation reference. Examine each element for color consistency, accuracy, and proper design dimension.

L. Request inspection by the Architect/Designer if there are variations in color, pattern, or design that are considered to be excessive.

M. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

N. Install termination trim.

O. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 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.

3.05 PROTECTION

A. Do not permit construction activities at or near finished graphics areas.

END OF SECTION

SECTION 09 8400
ACOUSTICAL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric-covered fiberglass core panels and mounting accessories.

B. Formed fire resistant plastic panels

C. Cementitious wood fiber acoustical panels

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available .

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Closeout Submittals
   1. Submit under provisions of Section 01 7800 - Closeout Submittals.
   2. Submit Material Safety Data Sheets under provisions of Section 01 7800 - Closeout Submittals for the following items:
      a. All mastics, glues, and adhesives
      b. Thermal insulation (excluding fiberglass, foam, rubber)

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

1.07 WARRANTY

A. Comply with requirements of Section 01 7800 - Closeout Submittals.

B. Submit a written warranty, executed by the Contractor, agreeing to repair or replace panels that fail in materials or workmanship within the specified warranty period.
   1. Warranty Period: Two (2) years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fabric-Covered Acoustical Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. AVL Systems, Inc.: www.AVLonline.com
   3. CertainTeed Corporation: www.certainteed.com.
   4. Conwed Designscape | Wall Technology: www.conweddesignscape.com.
   5. Essi Acoustical Products Company: www.essiacoustical.com.
   6. Quiet Technology Systems: www.qtechsys.com
   7. USG: www.usg.com.
   8. Wenger Corporation: www.wengercorp.com.
   9. Substitutions: See Section 01 6000 - Product Requirements.

B. Cementitious Wood Fiber Acoustical Panels
   1. Cardinal Acoustics: www.cardinalacoustics.com
   2. Tectum, Inc.: www.tectum.com
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FABRIC-COVERED ACOUSTICAL PANELS

A. Panels: Prefinished, factory assembled fabric-covered panels.
   1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Fiberglass Core Panels: Typical, Unless Noted Otherwise
   1. Density: 6 to 7 lb/cu ft.
   2. Noise Reduction Coefficient (NRC): 0.80 to 0.90 when tested in accordance with ASTM C423for Type A mounting, per ASTM E795.
   3. Panel Width: As detailed.
   4. Panel Height: As detailed.
   5. Panel Thickness: 2 inch.
   6. Edges: Perimeter edges reinforced by a formulated resin hardener.
   7. Edge Profile: Beveled
   8. Corners: Square.
   9. Mounting: Mounting shall be continuous Z-bars per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise.

C. Fiberglass Core and Formed Fire Resistant Plastic Panels: Band and Choir Rooms
   1. Absorber Panels:
      a. Fiberglass Core Density: 6 to 7 lb/cu ft.
      b. Edges: Perimeter edges reinforced by a formulated resin hardener.
      c. Panel Thickness: 2 inch at Music, Choir and 4 inch at Band Halls.
      d. Edge Profile: Square
      e. Corners: Square.
   2. Diffuser Panels:
      a. Diffuser Construction: 0.125 inch Thermo-formed fire resistant plastic molded to a one-piece Barrel or a special offset Pyramidal shape.
      b. All diffuser panels constructed of Class A materials (NFPA 101 Life Safety Code Requirements for Class A Interior Finishes are: Flame Spread 0-25, Smoke Developed 0-450).
      c. Edge Profile: No flange for walls and hardware ceiling mount.

d. Corners: Radiused.

3. Acoustical Performance Requirements
   a. Sound absorption coefficients, measured with a Type A and Type E-400 mounting, according to ASTM E795 (if applicable) or according to application mounting method, determined by ASTM C423.
   b. Sound Transmission Class (STC), determined according to ASTM E90 and ASTM E413: Type I convex ceiling diffuser panel, 4' x 4'; STC 23; Type I pyramidal ceiling diffuser panel, 4' x 4'; STC 22.
4. Finishes
   a. Ceiling/Wall-mounted absorber panels: Fabric wrap entire core and glued to back of panel.
   b. Ceiling/Wall-mounted diffuser panels: Manufacturer's standard white, "orange peel" texture.
5. Mounting Hardware
   a. Wall mounting (absorbers and diffusers): Continuous wall and panel Z-bars per architectural drawings. Provide 2" minimum clearance above top of panel for placement and removal of panel.
   b. Ceiling mounting (absorbers and diffusers): Four corner hook suspended by wire to ceiling; lay-in hardware for ceiling grid; (minimum frame width 15/16"); direct ceiling mounting hardware.
6. Panel Width: As detailed.
7. Panel Height: As detailed.

D. Fabric Covering: Seamless fabric facing material, for bonded covering of core material.
1. Fabric shall be applied directly to the face and edges of the panel and return to the back of the panel to provide a full finished edge. All corners are fully tailored.
2. Fabric: See Section 01 6210 - Schedule of Materials and Colors for fabric selection.
3. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.

2.03 CEMENTITIOUS WOOD FIBER ACOUSTICAL PANELS

A. Standard Interior Wall Panels:
1. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
2. Thickness: 2 inch.
3. Panel Dimensions: Reference drawiongs
4. Color: Natural
5. Mounting: Mounting shall be continuous Z-bars per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise.
6. Performance Requirements:
   a. Provide acoustical wall panel assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
      1) Flamespread: 0.
      2) Smoke Developed: 0.
   b. Provide acoustical wall panel system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating as follows:
      1) Panel thickness of 2 inches: 0.60 minimum.

2.04 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.05 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
   1. Mounting shall be continuous Z-bars per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise

B. Ceiling-Suspended Accessories: Manufacturer's standard through-threaded eyelets bolted through concealed perimeter frame at 1/4 points on each panel, sized appropriately for weight of panels.
   1. Provide galvanized wire for suspension from ceiling at heights indicated.

C. Trim Moldings: Manufacturer's standard wood or vinyl trim moldings for concealing panel joints; color as selected from manufacturer's standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

B. Install panels to construction tolerances of plus or minus 1/16 inch for the following:
   1. Plumb and level.
   2. Flatness.
   3. Width of joints.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.

B. Section Includes, but is not limited to:
   1. Exterior paints and coatings systems including; paints, stains, transparent coatings, and opaque finishes.
   2. Interior paint and coatings systems including; paint, stains, transparent coatings, and opaque finishes.
   3. Specific products and painting scheduled in this Section are based, in general, on products of Sherwin-Williams Company (noted SW). Products of other manufacturers listed in paragraph 2.01 may be substituted with approved color matches.

1.02 RELATED SECTIONS

A. Section 05 2100 - Steel Joist Framing: Shop priming

B. Section 05 5000 - Metal Fabrications: Shop priming

C. Section 06 2000 - Finish Carpentry: Back priming of trim and paneling

D. Section 07 8123 - Intumescent Fire Protection: Field-applied paints coordination with intumescent fireproofing substrate.

E. Division 23 - Mechanical Identification: Markers and color-coding

F. Division 26 - Electrical Identification: Markers and color-coding

1.03 REFERENCES

A. Industry Association Standards
   1. SSPC-SP 1 - Solvent Cleaning.
   2. SSPC-SP 2 - Hand Tool Cleaning.
   3. SSPC-SP 3 - Power Tool Cleaning.
   4. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

1.04 DEFINITIONS

A. Paint
   1. Means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.05 SUBMITTALS

A. Shop drawings, product data, and samples under provisions of Section 01 3000 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each paint and coating product should include:
   1. Product characteristics
   2. Surface preparation instructions and recommendations
   3. Primer requirements and finish specification
   4. Storage and handling requirements and recommendations
   5. Application methods
   6. Cautions

C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.

D. Verification Samples: For each finish product specified, submit 8”x10” samples that represent actual product, color, and sheen.

E. Closeout Submittals
   1. Submit under provisions of Section 01 7800 - Closeout Submittals.
   2. Upon conclusion of the project, the Contractor or paint manufacture/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Single Source Responsibility:
      a. Obtain each type of material required from single source.

B. Pre-installation Meetings
   1. Comply with provisions of Section 01 3000 - Administrative Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 - Product Requirements.

B. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
   1. Product name, type (description)
   2. Application and use instructions
   3. Surface preparation
   4. VOC content
   5. Environmental issues
   6. Batch date
   7. Color number

C. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

D. Store materials in an area that is within the acceptable temperature range, per manufacturers instructions. Protect from freezing.

E. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.08 PROJECT CONDITIONS

A. Project Environmental Requirements
   1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

1.09 MAINTENANCE

A. Extra Materials
   1. At completion of project, deliver to Owner extra stock of materials used on project as follows:
      a. High School - Twenty (20) gallons for each field color/type, five (5) gallons for trim and accent of each color/type.
      b. Junior High/Middle School - Fifteen (15) gallons for each field color/type, four (4) gallons for trim and accent of each color/type.

c. Elementary/Intermediate School - Ten (10) gallons for each field color/type, three (3) gallons for trim and accent of each color/type.
d. Additions and Renovations - Five (5) gallons for each field color/type, two (2) gallons for trim and accent of each color/type.

2. Store in location as directed by Owner.
3. Ensure containers are sealed and identified by manufacturer, type, and color.
4. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.
5. Include cleaning methods, and recommended cleaning solutions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements indicated herein, provide products of one of the listed manufacturers.

B. Sherwin-Williams Co.: www.sherwin-williams.com.

C. Kelly-Moore Paints: www.kelleymoore.com.

D. PPG Paints: www.ppgpaints.com

E. Benjamin Moore & Co.: www.benjaminmoore.com.

F. TNEMEC Company Inc.: www.tnemec.com.

G. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL

A. Paints and Coatings - General:
1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

B. Primers:
1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Compatibility with other materials:
1. Topcoats: Suitable for application over applied intumescent coatings; of type recommended in writing by intumescent coatings manufacturer for each fire resistance design. Topcoat to have been tested by manufacturer for compatibility in fire conditions with documentation of such tests to be provided upon request. Color of topcoat shall be as selected by the architect. Colors shall not be limited to manufacturer's standard colors.
2. See Section 07 8123 - Intumescent Fire Protection for additional information.

2.03 COLOR SCHEDULES

A. Color schedule in Section 01 6210 - Schedule of Materials and Colors.

B. The Architect may select, allocate, and vary colors on different surfaces throughout the Work, subject to the following.
1. Exterior work: A maximum of three (3) different colors will be used, with variations for trim, doors, miscellaneous work, and metal work.
2. Interior work: A maximum of ten (10) different pigmented colors will be used, with variations for trim and wall surfaces and wainscots.
3. Dark tones: A maximum of five (5) dark tones will be used as accent colors for interior.

C. All painted graphics shown on the drawings shall be included in the base proposal and shall be included in this section. Contractor shall note that school colors and mascot may be released after initial color selection. Contractor shall make all necessary adjustments.

2.04 MISCELLANEOUS MATERIALS

A. Coating Application Accessories
   1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer's specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.02 PREPARATION

A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.

B. The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

C. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

D. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions.

E. Methods:
   1. Concrete Masonry Units
      a. Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F. The pH of the surface should be between 6 and 9, unless the products to be used are designed to be used in high pH environments such as Loxon. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.
   2. Concrete, SSPC-SP13 or NACE 6
      a. This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
   3. Drywall-Interior

a. Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

4. Galvanized Metal
   a. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.
5. Steel: Structural, Plate, Doors and Frames, etc.
   a. Should be cleaned by one or more of the surface preparations described below. All metal shall be thoroughly prepared to ensure adhesion of new paint to the prepared surface. All prepared surfaces shall be observed and approved by the Owner or Owners Representative before new paint is applied.
   b. Solvent Cleaning, SSPC-SP1
      1) Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
   c. Hand Tool Cleaning, SSPC-SP2
      1) Hand Tool Cleaning removes all loose mill scale, loose rust and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
   d. Power Tool Cleaning, SSPC-SP3
      1) Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
6. Stucco
   a. Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products to be used are designed to be used in high pH environments such as Loxon.
7. Wood-Exterior
   a. Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.
8. Wood-Interior
   a. All finishing lumber and flooring must be stored in dry, warm rooms to prevent absorption of moisture, shrinkage, and roughening of the wood. All surfaces must be sanded smooth, with the grain, never across it. Surface blemishes must be corrected and the area cleaned of dust before coating.

3.03 APPLICATION

A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Testing: Due to the wide variety of substrates, preparation methods, application methods and environments, one should test the product in an inconspicuous spot for adhesion and compatibility prior to full-scale application.

C. Apply all coatings and materials with manufacture specifications in mind. Mix and thin coatings according to manufacture recommendation.

D. Do not apply to wet or damp surfaces.
   1. Wait at least 30 days before applying to new concrete or masonry. Or follow manufactures procedures to apply appropriate coatings prior to 30 days.
   2. Test new concrete for moisture content.
   3. Wait until wood is fully dry after rain or morning fog or dew.

E. Apply coatings using methods recommended by manufacturer.

F. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

G. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

H. Regardless of number of coats specified, apply as many coats as necessary for complete hide.

I. All drywall installation areas shall be made ready for painting by first preparing the gypsum wallboard surfaces with texturing as specified. Apply in strict compliance with manufacturer's written directions. Omit texturing where wall carpet occurs, reference Finish Schedule on drawings.

J. At gymnasiums, contractor shall paint wood blocking for gym equipment supports to match adjacent color. Contractor shall coordinate the sequencing with all trades.

K. Exterior Woodwork: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 2 weeks.

L. Miscellaneous surfaces and procedures
   1. Exposed mechanical items
      a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
      b. Paint visible duct surfaces behind vents, registers, and grilles Sherwin Williams Pro Mar Flat Black.
      c. Wash metal with solvent, prime, and apply two coats of alkyd enamel.
   2. Exposed pipe and duct insulation
      a. Apply one coat of latex paint on insulation which has been primed under other Sections; apply two coats on such surfaces when unprepared.
      b. Match color of adjacent surfaces.
      c. Remove band before painting, and replace after painting.
   3. Hardware: Paint prime coated hardware to match adjacent surfaces.
   4. Wet areas
      a. In toilet rooms and contiguous areas, add an approved fungicide to paints.
   5. Exposed vents: Apply two coats of heat-resistant paint approved by the Architect.

M. Inspection: The coated surface must be inspected and approved by the architect just prior to each coat.

3.04 REPAIR/RESTORATION

A. For surfaces that are to receive new finish, prepare surface and apply materials as described below and per manufacture recommendation.

B. Preparation of Existing Surfaces That Have Been Previously Painted or Varnished:
   1. The workmanship shall be best quality, and the surface shall be prepared in a thorough manner in order that the new finish shall be as finished as if the surface had been new with all the usual preparation for new paint or varnish.
   2. All previously painted or varnished surfaces or surfaces that have been previously finished in any manner shall first be prepared to receive new finish or any sort, according to the following specifications:

a. Existing painted sand finish plaster walls to be repainted
   1) Remove all scaled or loose paint.
   2) Fill all cracks in plaster as follows:
      (a) Large cracks - caulk with latex sealant.
      (b) Hairline cracks - Add 1 lb. of taping cement to 1 gallon of latex paint and brush across cracks until filled.

b. Existing enamel or varnished surfaces on smooth plaster or any surface
   1) Add 4 tablespoons of Tri-Sodium Phosphate per quart of paint thinner and wash surfaces to be repainted not less than 4 hours nor more than 7 hours before painting first coat.

c. Existing drywall partitions to receive new base.
   1) Upon removing existing rubber base, prepare wall surface to receive new base. Surface shall be leveled to meet adjacent surface. Texture wall as required to match existing.

C. Painting Existing Surfaces after Surfaces Have Been Prepared
   1. Sand Finish Plaster
      a. One coat primer-sealer colored to match finish coat. Primer-sealer will be SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
      b. One coat of paint shown on schedule or two coats if required to fully cover for first quality finish.
   2. Concrete Masonry Units
      a. Same as sand finish plaster.
   3. Smooth Plaster Walls
      a. One coat SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
      b. Second coat will be as directed by the Architect.
   4. Varnished Surfaces to be Revarnished
      a. Repair scratches with SW Wiping Stain, S64 series.
   5. Enameled Trim:
      a. Apply one coat SW Premium Wall & Wood Primer, B28W8111.
      b. Second coat will be as directed by the Architect.
   6. Hollow Metal Trim (Existing)
      a. Same as enamel trim.

3.05 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

PART 4 - SCHEDULES

4.01 GENERAL

A. The Painting Schedule of this Section is based, in general, on products of Sherwin-Williams Company (noted SW on the schedule).

B. Where painting occurs in addition or renovation projects provide low odor finishes equal to Sherwin Williams ProMar 200 Zero VOC Series.

C. The various surfaces and areas receiving finishes maybe indicated on the drawings or as noted below. The desired finishes are shown by code numbers. Not all codes listed below may be used. The required materials for each code number shown on the finish schedule are specified below under the corresponding code numbers.

4.02 PAINTING SCHEDULE

A. Code 100a - Exterior Metal
   1. Including flashing, vents, doors, window trim and grilles (except aluminum, other non-ferrous metals, and galvanized metal)
   2. 1st Coat: SW ProCryl Universal Metal Primer, B66-1300 series.
   3. 2nd/3rd Coat: SW Pro Industrial WB Alkyd Urethane Enamel Semi-Gloss, B53-1150 series.

B. Code 100b - Exterior Metal
   1. Including aluminum and galvanized metals
   2. 1st/2nd Coat: SW ProCryl Universal Metal Primer, B66-310 series.
   3. 3rd/4th Coat: SW Pro Industrial Acrylic Semi-Gloss, B66-650 series.

C. Code 100c - Exterior Metal
   1. For use on exterior painted handrails and exposed structural steel over properly prepared steel (SSPC SP-6 Commercial Metal Blast, 2-3 mil profile).
   2. 1st Coat: SW Macropoxy 646 FC Epoxy B58 series
   3. 2nd/3rd Coat: Sher-Loxane 800 B80 series

D. Code 101 - Exterior Wood
   1. Including wood doors, screens and trim
   2. 1st Coat: SW Exterior Oil-Based Wood Primer, Y24W8020.
   3. 2nd/3rd Coat: A-100 Exterior Acrylic Satin, A82-series.

E. Code 102a - Exterior CMU
   1. 1st Coat: SW PrepRite Block Filler, B25W25.
   2. 2nd/3rd Coat: SW A-100 Exterior Acrylic Satin, A82-series

F. Code 102b - Exterior Cement Board
   1. 1st Coat: SW Loxon Concrete & Masonry Primer, LX2W50.
   2. 2nd/3rd Coat: A-100 Exterior Acrylic Satin, A82-series.

G. Code 103 - Interior Wood (Natural Wood)
   1. 1st Coat: Minwax Performance Fast-Dry Sanding Sealer, 81580.
   2. 2nd/3rd Coat: Minwax Performance Series Fast-Dry Varnish 9150/9151 Series.

H. Code 104a - Interior Wood (Painted Surface, Enamel):
   1. 1st Coat: SW Premium Wall & Wood Primer, B28W8111.
   2. 2nd/3rd Coat: SW Solo 100% Acrylic Semi-Gloss, A76 series.

I. Code 104b - Interior Metal (Painted Surface, Enamel)
   1. 1st Coat: ProCryl Universal Metal Primer, B66-1300 series.
   2. 2nd/3rd Coat: Pro Industrial WB Alkyd Urethane Enamel Semi-Gloss, B53-1150 series.

J. Code 105 - Interior Wood (Stain & Finish)
   1. 1st Coat: SW Sher-Wood Wiping Stain, S64 series. (color as selected by Architect)
   2. 2nd Coat: SW Pro Mar B44FT4 Lacquer Sanding Sealer
   3. 3rd Coat: SW Pro Mar B44FT7 Satin Lacquer

K. Code 106 - Interior Masonry (Admin Areas)
   1. 1st Coat: SW Loxon Concrete & Masonry Primer, LX2W50.
   2. 2nd/3rd Coat: SW ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 series.

L. Code 107 - Interior Masonry (Corridors and Student Areas)
   1. 1st Coat: SW Loxon Concrete & Masonry Primer, LX2W50.
   2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Semi-gloss, B31-2600 series.

M. Code 107a - Interior Masonry (Sound Rated Partitions)
   1. 1st/2nd Coat: SW Loxon Concrete & Masonry Primer, LX2W50.

2. 3rd/4th Coat: SW Pro Mar 200 Zero VOC Latex Semi-gloss, B31-2600 series.

N. Code 108 - Interior Metal, Natatoriums (Painted Surface, Enamel)
1. Surface Preparation: SSPC-SP 6/NACE 3.
2. 1st Coat: SW, Series, B65G10, Corothane I Galvapac 2K Zinc Primer, DFT 3.0-4.0 mils
3. 2nd Coat: SW, Series B58-600, Macropoxy 646 Fast Cure Epoxy, DFT 5.0-10.0 mils
4. 3rd Coat: SW, Sher-Loxane 800, Two Component Polysiloxane, DFT 4.0-6.0 mils.
5. Total DFT 12-20 mils.

O. Code 109 - Floors (Two Component Epoxy Coating)
1. 1st Coat: SW ArmorSeal 33 Epoxy Primer/Sealer, B58 series.
2. 2nd/3rd Coat: SW ArmorSeal 1000 HS, B67-2000 series
3. At locker rooms and wet or damp areas provide anti-slip agent equal to one of the following:
   a. H&C Concrete Products, Sharkgrip Slip Resistant Additive
   b. QC Construction products, QC Sure Trac

P. Code 110a - Two Component Epoxy Coating for CMU Walls (All Foodservice Areas)
1. 1st Coat: SW Pro Industrial Heavy Duty Block Filler, B42W150. This material is to be applied at the rate of 75sq. ft. per gallon or until surface is filled free from any voids or holes. Surface is to be filled free from excess mortar and cracks.
2. 2nd/3rd Coat: SW Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.

Q. Code 110b - Two Component Epoxy Coating for Gyp Board Walls (All Foodservice Areas)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.

R. Code 110c - Epoxy for CMU Walls at "Wet/Shower" Areas, Restrooms, Vehicle Wash Bays, Natatoriums, Janitor, & Mechanical Rooms
1. 1st Coat: SW Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400.
2. 2nd/3rd Coat: SW Water Based Epoxy B70 Series/B60V15 Hardener.

S. Code 110d - Epoxy for Gyp Board Walls at "Wet/Shower" Areas, Restrooms, Vehicle Wash Bays, Natatoriums, Janitor, & Mechanical Rooms
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.

T. Code 111 - Exterior Concrete Walls (Painted or Unpainted)
1. After all work has been completed, apply 2 coats of Sure Klean "Weather Seal SS" as manufactured by Prosoco, Inc., Dallas, Texas or prior approved equal. Apply in full compliance with manufacturer's specifications.

U. Code 112 - Exterior Concrete or Stucco
1. 1st/2nd Coat: Master Builders Solutions, MasterProtect HB 200. Apply according to manufacturer's specifications for complete coverage and comply with manufacturer's five year guarantee on labor and materials. Secure and deliver to the Architect the manufacturer's standard five year guarantee.

V. Code 113 - Graffiti Resistant Coating
1. Coating shall be a clear, non-sacrificial graffiti resistant coating which provides protection for exterior vertical surfaces from permanent graffiti staining and damage caused by spray paint and marking pens. Coating shall be suitable for application to painted and unpainted surfaces including masonry, concrete, metals, and EIFS. Product shall be of type such that recoating with the underlying paint is possible without removal of the graffiti resistant coating. Product shall be a coating that dries clear, non-yellowing, with a low luster.
   a. Basis of Design: VandlGuard Single-Part Urethane Non-Sacrificial Graffiti Coating
      1) Micro-Seal Water Repellant (One Coat) by Rainguard International,
         (a) For first coat for unpainted concrete and masonry surfaces

2) Graffiti Remover: VandlClean Super graffiti remover by Rainguard International,

W. Code 114 - Green Screen Paint
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: Water Based Acrylic Chroma Key Matte Green Video Paint.

X. Code 115a - Interior Drywall (Admin Area Walls and Ceilings/Bulkheads)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20-2600 series.

Y. Code 115b - Interior Plaster (Standard Ceilings/Bulkheads)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20-2600 series.

Z. Code 116a - Interior Drywall (Walls in Corridors and Student Areas)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20-2600 series.

AA. Code 116b - Interior Plaster (High Humidity Ceilings)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Pre-Catalyzed Waterbased Epoxy Semi-Gloss, K46-150 series.

BB. Code 117 - Exterior Masonry Surfaces
1. 1st Coat: SW Loxon Concrete & Masonry Primer, LX2W50.
2. 2nd/3rd Coat: SW ConFlex XL Elastomeric Smooth, CF11W51Series.

CC. Code 118 - Interior Non-Textured Drywall (where painted or applied graphics occur)
1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd/3rd Coat: SW Cashmere Interior Acrylic Latex DP-D17W00151.

DD. Code 119 - Existing Metal - Electrostatic Enamel
1. Description: A single component modified acrylic enamel for use with electrostatic spray equipment.
2. Surface Preparation: Surface must be clean and free of oils, grease, loose paint, rust, polish, waxes and moisture. Sand and remove all ropes and runs on existing metal. Surface must have feathering around scratches. Test surface for priming and adhesion to determine if a base coat should be removed and primed.
3. 1st/2nd Coat: Electrostatic Enamel Semi-Gloss (182 Line - Sumter Coatings, Inc. Sumter, SC)
4. Primer: As recommended by manufacturer for existing application.
5. Applicators
   a. Electro-Static Refinishers Inc., Dallas, TX; 972-296-2173
   b. ElectroCoat, Houston, TX; 800-508-9449

EE. Code 120 - Exposed Structural Steel, Joist and Deck in Crawl Space
1. Surface Preparation: SSPC SP-6 Commercial Metal Blast, 2-3 mil profile.
2. 1st Coat: SW, Zinc Clad 4100 applied at 3-5 mils dry film thickness.

FF. Code 121 - Ceilings (Exposed Structural Steel and Deck)
1. Touch-up factory prime coat on ferrous steel with SW ProCryl Universal Metal Primer, B66-1300 series.
2. 1st /2nd Coat: SW APro Industrial Waterborne Acrylic DryFall Flat, B42W181.

GG. Code 122 - Not Used

HH. Code 123 - Concrete Floor Sealer:
1. Properly clean surface as per manufacturer's recommendations.
2. 1st/2nd Coat: BASF MasterKure CC 250 SB (Formerly Kure-N-Seal)
3. At locker rooms and wet or damp areas provide anti-slip agent equal to one of the following:

a. H&C Concrete Products, Sharkgrip Slip Resistant Additive
b. QC Construction products, QC Sure Trac

II. Code 124 - Structural & Miscellaneous Steel, Steel Bar Joists
1. 1st Coat: SW Opti-Bond (B50W100).

END OF SECTION

SECTION 10 1100
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards

B. Tackboards

C. Display Cases.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing.

B. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Manufacturer's printed installation instructions.

E. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. American Visual Display Products: www.americanvisualdisplay.com.

B. ASI Visual Display Products: www.asi-visualdisplayproducts.com.

C. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.

D. MooreCo, Inc: www.moorecoinc.com/#sle.

E. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.

F. Polyvision Corporation: www.polyvision.com/#sle.

G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY UNITS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Basis of Design: Claridge LCS3 Series 1.
   2. Color: Low Gloss, White.
   3. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .

4. Core: MDF, 7/16 inch thick, laminated to face sheet.
5. Backing: Steel back, laminated to core.
6. Size: As indicated on drawings.
7. Frame: Extruded aluminum , with concealed fasteners.
8. Frame Finish: Anodized, natural.
9. Markerboard Finish: Markerboard surface shall be consistent in appearance without fading or ghosting.
10. Accessories: Provide marker tray, map rail, flag holder, and metal display hooks at 2'-0" o.c. on map rail.
11. Omit marker tray in all "Activity Rooms", "Exterior Applications" and "Gymnasiums."

B. Tackboards: Fine-grained, homogeneous natural cork.
1. Acceptable Product: Claridge, Claridge Cork
2. Cork Thickness: 1/4 inch.
3. Color: As selected from manufacturer's full range.
4. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
5. Size: As indicated on drawings.
6. Frame: Extruded aluminum , with concealed fasteners.
7. Frame Finish: Anodized, natural.

C. Combination Units and Units Made of More Than One Panel: Factory-assembled 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.

D. Display Cases:
1. Basis of Design: The Tablet & Ticket Co., 900DC Display Case Series
   a. Frame Profile:
      1) Top and Bottom ¼” aluminum plate.
      2) Aluminum Tube perimeter frame
         (a) 1-1/2” x 1-1/2” x 1/8”wall
   b. Door Profile:
      1) Top and Bottom: 2-5/16”,4” or 6 inch heavy-duty pivot hinged 3/8”.
   c. Frame and Door Finish:
      1) Aluminum with anodized finish, Clear.
   d. Frame and Cabinet Construction:
      1) Casing: Aluminum extrusion mitered and assembled with concealed corner angles, capturing wood box.
      2) Lock: Manufactures standard lock.
   e. Shelving:
      1) Hanging Aluminum system with stainless steel cable, Adjustable clips.
      2) Backgrounds:
         (a) Back: Fabric over cork, fabric sides and top with maple veneer bottom
      3) Mounting Options:
         (a) Flat Mounting: Flat mount directory flush to wall surface.
   f. Acceptable Manufacturers:
      1) The Tablet and Ticket Company: www.tableandticket.com
      2) PYT Sports, Inc: www.pytsports.net
      3) Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

C. Medium Density Fiberboard (MDF): ANSI A208.2; composed of wood fibers pressure bonded with manufacturer's recommended adhesive to suit application.

D. Steel Sheet Backing: 28 gage, 0.0149 inch, galvanized.

E. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall , full width of frame.

B. Map Supports: Formed aluminum sliding hooks to fit map rail.

C. (2) Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board. Omit marker tray in all "Activity Rooms", "Corridors" "Exterior Applications" and "Gymnasiums."

D. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.

E. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as instructed by the manufacturer.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use, this includes wall anchors at 2’-0” o.c. and wall adhesive at maximum of 16” o.c.e.w.

B. Install with top of the marker tray at 15-48 inches above finished floor. Verify actual height with Owner before installation as required to accommodate writing, projection and viewing surface.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

3.04 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.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Building, Wayfinding and Title Signs.

C. Plaque.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. 2012 TAS - Texas Accessibility Standards; 2012.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Shop Drawings:
   1. Submit shop drawings showing each typical room and door sign type for fabrication, including typical drawings and details for each type to be provided.
   2. Submit shop drawings showing all graphic, wayfinding or other "special" signage for fabrication, including drawings and details for each to be provided.
   3. Shop drawings shall include plan location, directional information, size, font, color, mounting details, and scaled representation of configuration for each sign (included, but not limited to, building signs, directional/ wayfinding signs, and plaques) and graphic elements.

D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. Request content of signs from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

E. Building signage, including, but not limited to, directional/ wayfinding signs, plaques, graphic elements and marquee signs:
   1. ALL signage shall be submitted for approval by the Owner for content, color, size and other physical qualities.
   2. ALL signage shall not be fabricated or installed without the written approval of the Owner.

F. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

G. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

H. Verification Samples: Submit samples showing colors specified.

I. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 - Product Requirements.

B. Package signs as required to prevent damage before installation.

C. Package room and door signs in sequential order of installation, labeled by floor or building.

D. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Room and Door Signs:
1. Apco Architectural Signs: www.apco.com
2. ASI Signage: www.asisignage.com.
3. Benchmark Signs: www.benchmarksigns.biz.
4. Best Sign Systems, Inc.: www.bestsigns.com.
5. Bayuk Graphic Systems, Inc.: www.bayukgraphics.com.
6. Cosco Industries: www.coscoarchitecturalsigns.com.
7. FASTSIGNS: www.fastsigns.com.
8. Inpro: www.inprocorp.com.
9. Kroy Sign Systems: www.kroysignsystems.com.
10. Mohawk Sign Systems, Inc.: www.mohawksign.com.
11. South Texas Graphic Specialties, Inc.: www.stxgraphics.com.
12. Substitutions: See Section 01 6000 - Product Requirements.

B. Building, Wayfinding and Title Signs:
1. Cosco Industries: www.coscoarchitecturalsigns.com.
2. FASTSIGNS: www.fastsigns.com.
3. Inpro: www.inprocorp.com.
4. A.R.K. Ramos Signage Systems: www.arkramos.com.
5. ASI Signage: www.asisignage.com.
6. Best Sign Systems, Inc.: www.bestsigns.com
7. Gemini Inc.: www.geminisignproducts.com
8. The Southwell Company: www.southwellco.com.
9. Substitutions: See Section 01 6000 - Product Requirements.

C. Plaques:
1. Cosco Industries: www.coscoarchitecturalsigns.com.
2. Impact Signs: www.impactsigns.com
3. The Southwell Company: www.southwellco.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards, 2012 TAS,ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Basis of Design: Apco Architectural Signs; Elevate Series 1
   2. General:
      a. Sign system shall be frameless and shall feature solutions for all required sign types, including but not limited to wall mounted personnel signs, work station personnel signs, primary room identification, directories, directionals, overhead signs, projection wall signs, restroom signs, regulatory and information signs, stair signs and changeable slide conference room signs. All signs within the system must convey a uniform look throughout.
      b. See Schedule of Materials and Colors for additional information.
   3. Features:
      a. Sign Assembly:
         1) Sign shall feature a fully recessed chassis to which modular display panels securely engage, creating a frameless look with the appearance that display panels are floating off of the mounting surface.
      b. Display Panels / Inserts:
         1) Primary display panels shall be 1/8” thick painted acrylic plaques or 1/8” thick satin anodized aluminum plaques with direct-print graphics. Optional display panels shall be 3mm(1/8”) aluminum composite plaques with the .012” aluminum skin formed precisely around all four edges of the panel to conceal the panel’s composite core. Display panels engage with the concealed chassis in a precise manner to ensure a 1/16” reveal between all panels as a standard. An optional No-Reveal solution enables all panels to butt directly against one another with no inter-insert reveals.
      c. Full Bleed Graphics:
         1) System shall offer options for direct-print graphics that bleed around all four edges/returns of the display panels.
      d. Tamper Resistance:
         1) System must offer an option for a concealed locking method to increase level of tamper resistance.
      e. Mounting:
         1) Signs must be able to accommodate installation via fully concealed mechanical fasteners.
      f. Modularity:
         1) All display panels shall be securely engaged within a concealed chassis but must be easily updatable to accommodate change. Display panels must be removable without the use of a special, proprietary tool.
      g. User Letter Paper Inserts:
         1) System must offer solutions for user updatable paper inserts, including a range of perforated, coated paper and free software with templates for easy creation of graphics.
   4. Materials and Construction:
      a. Sign shall feature a fully recessed black anodized aluminum chassis to which modular display panels securely engage. Chassis shall be no more than 3/8" in depth and shall be recessed sufficiently behind the panels to give the appearance the panels/inserts are floating off of the mounting surface.

b. Primary display panels shall be 1/8” thick painted acrylic or 1/8” satin anodized aluminum with direct-print graphics. Optional display panels for full-bleed graphics shall be 3mm (1/8”) thick aluminum composite (ACM) with the .012” aluminum face formed precisely around all four edges of the panel to conceal its composite core. Display panels must securely engage with the recessed chassis via a concealed attachment method but should be 100% modular to accommodate changes.
c. System shall offer a range of aluminum bands to house user-updatable, perforated paper inserts. Inserts shall be retained on the left and right sides of the aluminum band by .020” clear, flexible end caps.
d. Standard ADA inserts/plaques are acrylic or aluminum with APCO’s DP-Tactile process direct-print, UV-cured 1/32” thick tactile characters and fully domed Braille.
e. Standard graphics are UV-cured, direct-print with true 600dpi resolution and the option to bleed around all four edges/returns of the ACM display panels.
f. Attachment: Signs shall be able to accommodate fully concealed mechanical fasteners.

5. All letters, numbers and/or symbols shall contrast with their background. Characters and background shall have a non-glare finish.
6. Background color as selected by architect from manufacturer’s actual color samples.
7. Letterform shall be Helvetica Regular upper case letters and numbers.
8. Size of letters and numbers shall be as follows:
   a. Owners Room numbers shall be 1".
   b. Lettering for room ID signs shall be 3/4"or as noted.
   c. Provide construction floor plan room number in lower right hand corner on all signs. Number shall be 3/8” high and color shall match background.
   d. Symbol size shall be 4".
   e. Standard Grade 2 braille shall be ½" below copy.
   f. Corners: Square edges.
9. Provide solid cover plate for back side of sign where mounted to glass.
10. Entry/Exit Numbering: Provide 4" high door number on each side of all exterior doors for First Responder information. Numbers shall start at main primary entry and continue sequence in clockwise direction around the building.
11. Exterior Room Identification Signage
    a. Provide cast aluminum sign with raised letters and border.
    b. Raised letters and border shall be satin finish with painted background.
    c. Signs shall have room function followed by Grade 2 Braille directly below.
    d. Provide at all exterior mechanical, electrical, fire riser rooms or other exterior locations.

C. Code Required Signage: Fire Protection and Utility Equipment Identification Access and Emergency Signage. See "Schedules" article below.

D. Building, Wayfinding and Title Signs:
1. Building Letters.
   a. Use individual cast aluminum alloy, smooth surface letters.
   b. Letters shall be Arial for bidding purposes unless noted otherwise on the drawings.
   c. Finish shall be baked enamel, primed and spray coated with two (2) coats of baked enamel.
   d. Reference drawings for font heights and locations.
   e. Font and finish are for bidding purposes only. Submit samples to Architect for approval before fabrication of any material
   f. Provide (5) 8" high numbers for the building address. Verify location with Building Inspector. Color shall be contrasting to building. Provide one set per building.

2. All exterior wall, roof, and structure mounted letters/signs to be engineered by the sign manufacturer for mounting requirements and structural connections in accordance with the applicable wind loading and building codes. Sign manufacturer shall coordinate with adjacent building trades for connection requirements prior to other building elements being installed.

E. Plaques:
1. Provide 1 stainless steel plaque per building.
a. Design shall be as detailed in this section.
b. Tablet to be 18" x 18". ¼" thickness.
c. The plaque shall be etched stainless steel background, free of all pits and gas holes, with raised borders and characters. All characters shall be sharp.
d. Border and faces of raised characters are to be a polished finish and background is to be brushed finish.
e. The plaque shall contain the names of the Superintendent of Schools, School Board members, the Architect, the Contractor, the Year and Title of the Building. Names and all edits to be given by Owner. If the size is not large enough to accommodate all the information given above, the plaque size shall be increased accordingly to 18" x 24".
2. Mount the plaque where directed by the Architect.

2.03 ACCESSORIES

A. Countersunk Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape and clear silicone adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
1. Examine work area with installer present.
2. If existing conditions are not as required to properly complete the work of this section, notify Architect.
3. Do not proceed with installation until deficiencies in existing conditions have been corrected.

B. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION

A. Interior/Exterior Room and Door Signage
1. Install in accordance with manufacturer's instructions.
2. Install neatly, with horizontal edges level.
3. Locate signs where indicated:
a. Room and Door Signs: Contractor shall locate specific mounting heights in coordination with the current TAS and ADA regulations. Mount sign on wall or glass.
b. If no location is indicated obtain Owner's instructions.
c. Wall or Glass Mounted: Double sided vinyl tape and clear silicone adhesive. Provide solid cover plate for back side of sign for glass installations.
d. Wall Mounted Directly to Masonry: Screw mount with four corner countersunk screws evenly spaced from each corner. Screw color to match sign color.
4. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

B. Building Identification Signage

1. General: locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
2. Install signs level, plumb, and at the height indicated with sign surfaces free from distortion or other defects in appearance.
3. Cleaning and Protection: After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the owner.

3.03 SCHEDULES

A. Interior/Exterior Room and Door Signage:
   1. Type A - ID signs with room number with one window slot. Window insert shall be fixed.
      a. Locations – Classrooms, offices.
   2. Type B - ID signs with room number and function.
      a. Locations – All locations except classrooms, offices.
      b. Provide "Roof Access" sign to rooms housing roof access hatch and ladder
      c. Provide "Maximum Occupancy" signs at the following locations;
         1) Lecture Hall
         2) Cafeteria
         3) Auditorium
         4) Gymnasium
         5) Activity Room
      d. Provide "Exterior Room Identification Signage" at all exterior mechanical, electrical and fire riser rooms.
   3. Type C - Restroom signs with 4" accessibility and gender symbol with the verbal description placed directly below and followed by Grade 2 braille.
   4. Type D - Pictogram signs with 4" accessibility and function symbol with the verbal description placed directly below and followed by Grade 2 braille.
      a. Messages: Text will be room names as directed by the Architect.
      b. Provide signage outside each assembly entrance stating "Assistive Listening Devices Available" with the international symbol of access for hearing loss.
      c. Locations – Auditoriums, Distant Learning Rooms, Cafeterias, and Gymnasiums

B. Code Required Signage.
   1. Fire Protection Equipment Identification, exterior access.
      a. Location(s): Permanently installed and readily visible. Verify mounting location with AHJ.
         1) Fire Suppression Sprinkler Riser and Valve Rooms.
      b. Copy: "RISER ROOM".
      c. Color: Copy to be White in contrast to its Red background.
   2. Fire Protection and Utility Equipment Identification, interior access.
      a. Location(s): Verify mounting location with AHJ.
         1) Air-Conditioning Systems Control Rooms.
         2) Fire Suppression Sprinkler Riser and Valve Rooms.
         3) Fire Detection, Suppression or Control.
      b. Copy: For bidding purposes, use room name as indicated on drawings. Verify final copy with Architect prior to fabrication.
      c. Color: Copy to be in contrast to its background.
   3. Elevator Lobby Emergency Signs: Provide one standardized design posted adjacent to each elevator call station on all floors. Copy: "IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS".
   4. Raised Character and Braille Exit Signs: A sign stating "EXIT" in visual characters, raised characters and braille and complying with ICC A117.1 shall be provided adjacent to each door to an area of refuge, providing direct access to a stairway, an exterior area for assisted rescue, an exit stairway or ramp, an exit passageway and the exit discharge.

C. **Plaque Example:**



END OF SECTION

SECTION 10 2113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

C. Solid plastic shower and dressing compartments.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

B. Section 05 5000 - Metal Fabrications: Concealed steel support members.

C. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, 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, floor, and ceiling supports, door swings.

D. Color charts showing colors available from the proposed manufacturer in the specified products.

E. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 WARRANTY

A. Provide fifteen year manufacturer warranty against plastic breakage, corrosion, and delamination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Toilet and Shower Compartments:
   1. Accurate Partitions Corp.: www.accuratepartitions.com.
   2. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor and ceiling anchored.
   1. Color: As scheduled in Section 01 6210 - Schedule of Materials and Colors.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 28 inch.
   3. Width for Accessible Use: 36 inch, out-swinging. (minimum)
   4. Width for Ambulatory Use: 34 inch, out-swinging.
   5. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 55 inch, mounted 14" above the finished floor.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets with vertical support/bracing same as compartments.

F. Shower Cubicles shall be 1" thick with all edges rounded to a 1/4" radius. Standard vanity size is 24" wide by customer specified length not to exceed 120" for a single piece.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor and ceiling 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. Wall, Pilaster, and Shower Brackets: Stainless steel; continuous type.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

D. Hinges: Stainless steel, manufacturer's standard finish.
   1. Continuous-type hinge, self closing.

E. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

F. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 1/4 inch to 3/8 inch 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. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

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

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

C. Electric hand dryers.

D. Dressing benches, wall-mounted folding.

E. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000-Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

B. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017.

G. ASTM C1036 - Standard Specification for Flat Glass; 2016.

H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

B. Provide accessories for Integrated Room Mock-ups as required in Section 01 4000-Quality Requirements.

C. Review delivery dates for Owner-Furnished products.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

E. Closeout Submittals:
   1. Submit under provisions of Section 01 7800 Closeout Submittals.
   2. Maintenance Data: For accessories to include in maintenance manuals.

1.06 WARRANTY

A. Manufacturer’s Special Warranty: Manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period.
   1. All accessories not specifically listed otherwise, (1) year from date of Substantial Completion.
   2. Mirrors: Failures include, but are not limited to, visible silver spoilage defects; warranty period (5) years from date of Substantial Completion.
   3. Electric Hand Dryers:
      a. Sensors - (1) year from date of Substantial Completion.
      b. Motor Brushes - (3) years from date of Substantial Completion.
      c. All Other Components - (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. ASI - American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   3. Bradley Corporation: www.bradleycorp.com/#sle.
   4. GAMCO – (General Accessory Mfg. Co): www.gamcousa.com.
   5. Georgia-Pacific Professional: www.blue-connect.com/#sle.
   6. Kimberly Clarke Professional: www.kcprofessional.com.
   7. Solaris Paper: www.solarispaper.com.
   8. Substitutions: Section 01 6000 - Product Requirements.

B. Under-Lavatory Pipe Supply Covers:
   1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
   2. Substitutions: Section 01 6000 - Product Requirements.

C. Electric Hand/Hair Dryers:
   1. American Dryer, Inc: www.americandryer.com.
   2. ASI - American Specialties, Inc: www.americanspecialties.com.
   3. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   4. Bradley Corporation: www.bradleycorp.com.
   5. Dyson, Inc: www.dyson.com
   6. Excel Dryer: www.exceldryer.com/#sle.

7. World Dryer Corporation: www.worlddryer.com/#sle.
8. Substitutions: Section 01 6000 - Product Requirements.

D. Dressing Benches:
1. Access Able Designs, Inc.: www.accessabledesigns.com.
2. Substitutions: 01 6000 - Product Requirements.

E. Utility Room Accessories:
1. Bradley Corporation: www.bradleycorp.com.
2. Zurn Industries, LLC: www.zurn.com.
3. Substitutions: 01 6000 - Product Requirements.

F. Source Limitations: Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide four keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.

I. Expansion Shields: Fiber or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser, (**T1**): Double roll, surface mounted bracket type, stainless steel with hinged door, non-removable spindles, and tumbler lock designed to prevent theft of tissue roll.
1. Mounting: Surface mounted.
2. Products:
a. Basis of Design: Solaris Paper LoCor Top-Down Bath Tissue Dispense.

B. Paper Towel Dispenser, (**T6**): Roll paper type.
1. Cover: Translucent high impact plastic.
2. Paper Discharge: Auto-cut dispense.
3. Capacity: 8 inch diameter roll.
4. Mounting: Surface mounted.
5. Refill Indicator: Transparent viewing slot.

6. Products:
   a. Basis of Design: In-Sight Sanitouch HRT 1.75” HUB.

C. Soap Dispenser, (**T11**): Liquid soap dispenser, wall-mounted, surface, with black cover; push type soap valve, check valve, and window gauge refill indicator.
1. Minimum Capacity: 48 ounces.
2. Products:
   a. Basis of Design: Buckeye International 1.25L Stealth Dispenser.

D. Mirrors: Stainless steel framed, (**T9**) and (**T10**): 1/4 inch thick tempered safety glass; ASTM C1048.
1. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners; satin finish.
2. Back of unit shall be galvanized steel, secure to frame with concealed screws, equipped with integral horizontal hanging brackets and separate wall hanger for concealed mounting.
3. Products:
   a. Basis of Design: (**T9**), Bobrick B-165, single lavatory mirror, 18” x 30”.
   b. Basis of Design: (**T10**), Bobrick B-165, full-length mirror, 24” x 60”.

E. Grab Bars, (**T4**) and (**T5**): Stainless steel, textured surface.
1. Heavy Duty Grab Bars:
   a. Push/Pull Point Load: 250 pound-force, minimum.
   b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
   c. Finish: Satin with peened gripping surface.
   d. Length and Configuration: As indicated on drawings.
   e. Mounting: Flanges with concealed fasteners.
   f. Products:
      1) Basis of Design: (**T4**), Bobrick B-6206.99, 36 inch grab bar.
      2) Basis of Design: (**T5)**, Bobrick B-6206.99, 42 inch grab bar.

F. Sanitary Napkin Disposal Unit, (**T2**): Stainless steel, with self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Mounting: Surface mounted; refer to drawings.
2. Products:
   a. Basis of Design: Bobrick Model B-270 Stainless Steel napkin receptacle.

G. Single Robe Hook (**T13**): Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers (**T23**):
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with TAS/ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.
   a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   b. Comply with ASTM C1822, type indicated.
   c. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
   a. Basis of Design: Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.

2.06 ELECTRIC HAND DRYERS

A. Electric Hand Dryers, (**T7**): Traditional fan-in-case type, with downward fixed nozzle.
   1. Operation: Automatic Activator, 25 second run time.
   2. Mounting: Surface mounted.
   3. Cover: Stainless steel with brushed finish.
      a. Tamper-resistant screw attachment of cover to mounting plate.
   4. Heater: 900 W, minimum, at full power.
   5. Fan/Heater Control: Field adjustable down to approximately half-speed with corresponding reduction in heat output.
   6. Supply Voltage: 120 V, single phase, 60 Hz, nominal.
   7. Electric Hand Dryer Products:
      a. Basis of Design: World Dryer Corporation.

2.07 DRESSING BENCHES

A. Dressing Bench, Wall-Mounted Folding, (**T25**):
   1. Description: Stainless steel tubular frame, 42”W x 20”D seat and 500-lb. capacity.
      a. Seat: ½-inch slatted phenolic seat; color as selected by Architect.
   2. Mounting: Surface, anchored to wall.
   3. Basis of Design: Access Able Designs, Inc.; Model D-101-42: www.accessabledesigns.com.

2.08 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder, (**T24)**: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Three spring-loaded rubber cam holders.
   2. Length: ___ inches.
   3. Mounting: Surface.
   4. Products:
      a. Basis of Design: Bobrick B223 x 24.

B. Mop Basin Hose and Bracket, (**T24A**): Heavy-duty 5/8-inch, cloth-reinforced flexible rubber hose with 3/4-inch brass coupling. Stainless steel, Type 304, bracket with rubber grip.
   1. Length: 30 inches.
   2. Mounting: Surface.
   3. Products:
      a. Basis of Design: Zurn Light Commercial Plumbing Products; Zurn Z1996-HH: www.zurn.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. See Section 06 1000-Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

D. Locate accessories in order that they do not interfere with door swings or use of fixtures. Install recessed accessories after wall finishes have been completed.

E. Anchor accessories with bolts, plates, and approved type fasteners. Take down any loose items and repair damaged wall surfaces. Accessories anchored to toilet partitions shall be thru-bolted.

F. Mount surface mounted accessories to backup material with toggle bolts, plumb and align.

G. At metal stud partitions, provide fire-retardant treated wood blocking for anchorage of grab bars, wall-mounted seats and benches, baby changing stations, and other such wall-mounted accessories where additional loads are anticipated.
   1. For accessories protruding 3-inches or less from the wall, Contractor may utilitize ClarkDietrich Danback Flexible Wood Backing System with FlamePRO fire-retardant treated wood.

H. At recessed electric hand dryers located in metal stud wall partitions, install rigid sound insulation in wall around unit.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

3.05 SCHEDULE

A. Provide the following accessories at type of room scheduled, whether indicated on the drawings or not. Refer to drawings for configuration and mounting heights. Provide (1) of each per accessory listed unless otherwise noted or designated as Owner-furnished.

B. Type C – Toilet Compartments
   1. Type C1 Standard Compartment:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
   2. Type C2, C3 and C5 Accessible Compartments:
      a. T1 Toilet Tissue (Roll) Dispenser
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
      c. T4 Grab Bars, 36 inch.
      d. T5 Grab Bars, 42 inch.
   3. Type C4 Ambulatory Accessible Compartment:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
      c. T5 Grab Bars, 42 inch; (2) each.

C. Type L - Lavatories:
   1. T9 Mirror.
   2. T11 Soap Dispenser. At locations with multiple lavatories, provide at a ratio of (1) dispenser per (2) lavatories.
   3. T23 Undersink Piping Covers per lavatory.

D. Type MS - Mop Sink Locations:

1. T24 Mop and Broom Holder.
2. T24A Mop Basin Hose and Bracket.

E. Type T – Toilet Rooms:
   1. Type T1 Single-User Toilet Room:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at unisex or designated female restrooms, grades 6 to adult only).
      c. T4 Grab Bars, 36 inch.
      d. T5 Grab Bars, 42 inch.
      e. T6 Paper Towel (Roll) Dispenser.
      f. T9 Mirror.
      g. T11 Soap Dispenser.
      h. T13 Coat/Clothes Hook.
      i. T23 Undersink Piping Covers.
   2. Type T2 Single-User or Family Toilet Room:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at unisex or designated female restrooms, grades 6 to adult only).
      c. T4 Grab Bars, 36 inch.
      d. T5 Grab Bars, 42 inch.
      e. T6 Paper Towel (Roll) Dispenser.
      f. T9 Mirror.
      g. T11 Soap Dispenser.
      h. T20 Baby Changing Station.
      i. T13 Coat/Clothes Hook.
      j. T23 Undersink Piping Covers.

F. Type WF - Wash Fountains
   1. T9 Mirror, one per station.
   2. T11 Soap Dispenser, (2) each.
   3. T23 Undersink Piping Covers, if wash fountain is not provided with skirt.

G. Break Rooms, Work Rooms, Clinics, Classrooms:
   1. T6 Paper Towel (Roll) Dispenser.
      a. At each sink location
   2. T11 Soap Dispenser.
      a. At each sink location

END OF SECTION

SECTION 10 4300
EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Bleed Control kit

C. Emergency Aid Cabinets.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide color and finish and installation instructions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

PART 2 PRODUCTS

2.01 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDS)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.
   1. Provide automated external defibrillators (AEDs) as indicated.
      a. Cardiac Science: Powerheart AED G3 Plus
      b. Defibtech: Lifeline AED - DDU-100 Package
      c. HeartSine Technologies: Samaritan PAD 350P (Public Access Defibrillator)
      d. Physio Control: Lifepak CR Plus AED

B. Provide AED's, cabinets and wall signs to be located as shown on the drawings. Cabinets shall be semi-recessed and shall not project more than 4" from the wall.

C. Provide one set of adult and pediatric electrode pads.

2.02 EMERGENCY AID CABINETS

A. Emergency Aid Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Modern Metal Products, a division of Technico, Inc: www.modern-metal.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Type: Multi-Use Emergency Aid.
   1. Provide interior fire rated, interior non-fire rated and exterior rated cabinets where indicated on the drawings.
   2. Cabinets shall have power outlet for charging of AED appliance.
   3. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
   4. Formed primed steel sheet; 0.036 inch thick base metal.
   5. Fire-Rated Cabinet Construction: Hourly rating as indicated on the drawings.
   6. Cabinet Configuration: Semi-recessed type.
      a. Size to accommodate AED, and Bleed Control Kit.
      b. Provide additional shelfs as needed to accommodate equipment.
   7. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.
   8. Fabrication: Weld, fill, and grind components smooth.
   9. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

2.03 BLEED CONTROL KIT

A. Basis of Design: Bleeding Control Station with Bleeding Control Kits by Rescue Essentials: www.rescue-essentials.com.

B. Bleeding Control Kit: Contents include:
   1. (1) CAT Tourniquet
   2. (1) Emergency Pressure Dressing, 4 inch
   3. (2) NAR S-Rolled Gauze, 4.5 inch x 4.1 yards
   4. (1) EMT Shears, 5.5 inch
   5. (1) Bleeding Control Instruction Card
   6. (2) Pairs of Nitrile Gloves, Large Size
   7. Fabrication: Weld, fill, and grind components smooth.
   8. Finish of Door Pull or Handle: Stainless steel.
   9. Finish of Cabinet Interior: White powder coat.
   10. Naloxone Overdose Emergency Kit: (4) doses minimum per cabinet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as units are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Touch up marred finishes. Replace products that cannot be restored to factory-finished appearance. Use materials and procedures recommended by manufacturer.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for closeout submittals.

B. See Section 01 7900 - Demonstration and Training for additional requirements.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguisher cabinets.

B. Accessories.

C. Fireman's Knox Items: Box, Padlock, and FDC Plug.

1.02 RELATED REQUIREMENTS

A. Section 01 4100 - Regulatory Requirements

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 DEFINITIONS

A. Where indicated on the Drawings, the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for a fire extinguisher without a cabinet.

1.04 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

C. UL (DIR) - Online Certifications Directory; Current Edition.

D. International Fire Code.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinquishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.

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.

G. Material and Safety Data Sheets for all mastics, glues, and adhesives and for insulating material for fire doors.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain products in this Section from one manufacturer.

B. Certifications

1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 - Product Requirements.

B. Store extinguishers in protected location until after final cleaning is completed.

1.08 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.09 WARRANTY

A. Comply with requirements of Section 01 7800 - Closeout Submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers and Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com.
   3. Larsen's Manufacturing Co: www.larsensmfg.com.
   4. Nystrom, Inc: www.nystrom.com/sle.
   5. Potter-Roemer: www.potterroemer.com.
   6. Samson Products, Inc.: www.samsonproducts.com.
   7. Strike First Corporation of America: www.strikefirstusa.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Fireman’s Knox Box:
   1. Knox Company; www.knoxbox.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 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.
   2. UL Rating: 2A-10B:C, minimum.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Product: MP10 for all typical installations.
   2. Product: MP5 at Elevator Equipment Rooms and Science Labs.
   3. Class: A:B:C type.
   4. Size: 5 and 10 pound.

C. Halotron I Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Product: HT5 at Computer Lab.
   2. Class: A:B:C type.
   3. Size: 5 pound.

D. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Product: WC-6L (6 liter capacity) at Kitchen (20 ft. away from hood).
   2. Class: K.
   3. Size: 1.6 gallons.

2.03 FIRE EXTINGUISHER CABINETS

A. Product - reference schedule below: Model numbers are based on Larsen's Manufacturing Co.

Wall Construction	Model	Fire Rated	Projection	Box Depth	Wall Depth
3-5/8" Metal Stud or 6" CMU	AL-2409-6R	No	2-1/2"	6"	4"
3-5/8" Metal Stud or 6" CMU	AL-FS-2409-R4	Yes	3-1/2"	6"	4"

8" CMU or wider	AL-2409-6R	No	2-1/2"	6"	4"
8" CMU or wider	AL-FS-2409-6R	Yes	2-1/2"	6"	4-7/8"
8" CMU	AL-2712-RA	No	4"	8"	4-1/2"
8" CMU	AL-FS-2712-RA	Yes	4"	8"	5-3/8"

B. Cabinet Configuration: Semi-recessed type.
   1. Projected Trim: Returned to wall surface, with 2-1/2 inch projection, and 1 inch wide face.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with continuous piano hinge. Provide solid doors at athletic and shop areas.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Clear satin anodized aluminum.

H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. If extinguisher is not located in a cabinet, provide bracket no. 860.

C. Graphic Identification: Applied decal use vertical decal spelling.

2.05 FIREMAN'S KNOX BOX

A. Provide and install emergency access lock box where shown on the drawings.
   1. Mount: Recessed (7"x7"x3.25"), provide recessed mounting kit with face flange. Mount at 6'-0" above ground level, verify with fire marshal.
   2. Lock: U.L. Listed. Double action rotating tumblers and hardened steel pins accessed by a biased cut key.
   3. Finish: Pre-treatment – Zinc Phosphate; Final Coating – weather resistant polyester powdercoat.
      a. Color: Black.
   4. Alarm: Alarm tamper switch. Connect to buildings security system.
   5. Model: "Knoxbox Series 3200".

B. Provide and install two-position electric override key switch with mounting plate. Provide lock cover with weather resistant operation and an emergency agency ID label. Controls emergency power system shutoff. Refer to electrical drawings for locations.
   1. Mount: Recessed, provide recessed mounting kit with face flange. Mount as directed by fire marshal.
   2. Alarm: Alarm tamper switch. Connect to buildings security system.
   3. Model: "Knoxbox 3502 with key switch".

2.06 FIREMAN'S KNOX PADLOCK

A. Provide padlock at access gates where indicated on plan.
   1. 3/8" diameter stainless steel shackle.
   2. Heavy-duty brass body with EPDM boot.
   3. Model: Knox 3753.

2.07 FIREMAN'S KNOX FDC PLUG

A. Provide FDC plugs at all locations.
   1. Plug shall be locking style with Knox key wrench.

2. Bright stainless cover.
3. Verify plug size and threads with Fire Department.
4. Model: Knox Model 3011.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings at locations shown on the Drawings. Install compliant with applicable accessibility requirements.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 10 7113.43
FIXED SUN SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular, shop fabricated, extruded aluminum sun screens to be mounted on structure provided by others.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting substrates.

B. Section 04 2000 - Unit Masonry: Mounting substrates.

C. Section 05 1200 - Structural Steel Framing: Mounting substrates.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, 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. Shop drawing sheets that include engineering information designed by the Contractor’s Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor’s Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

E. Samples: 12 inches by 12 inches minimum illustrating design, workmanship and finish color.

F. Sample of Louver: For review of shape only.

G. Designer's Qualification Statement.

H. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.

1.05 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 Texas.

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. With minimum five years of documented experience.
   2. Approved by manufacturer.

1.06 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.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, 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 ten year warranty on factory finish against cracking, peeling, and blistering for painted finishes and two years for anodized finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Sun Screens:
   1. Architectural Fabrication, Inc.: www.arch-fab.com
   2. AVAdek: www.avadek.com.
   3. Aluminum Techniques Inc.: www.aluminumtechniques.com
   4. Canopy Solutions, LLC: www.canopy-solutions.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUN SCREENS

A. Sun Screens: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.
   1. Configuration: As indicated on drawings.
   2. Louver Type: Slat.
   3. Outrigger Shape: Straight.
   4. Design Criteria: Design and fabricate to resist required loads without failure, damage, or permanent deflection.
   5. Provide a complete system ready for erection at project site.
   6. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B209 (ASTM 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.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 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 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.

3.02 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.

3.03 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.04 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.05 PROTECTION

A. Protect units after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 10 8213
ROOF SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof equipment screens and supporting steel framework. Screens shall be designed to attach to the equipment being screened and not the roof structure.

B. Roof screen accessories.

1.02 RELATED SECTIONS

A. Section 051200 - Structural Steel: Metal Framing.

B. Section 053100 - Steel Decking.

C. Section 055000 - Metal Fabrications: Frames and supports.

D. Section 077213 - Roof Curbs.

E. Section 099100 - Paints and Coatings: Field applied paint finish.

F. Division 23 - Roof Top HVAC Equipment.

1.03 REFERENCES

A. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM A 1008 - 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.

E. ASTM B 749 - Standard Specification for Lead and. Lead Alloy Strip, Sheet, and Plate Products.

F. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing.

G. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

H. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

J. AWS D1.1 - Structural Welding Code - Steel.

K. AWS D1.6 - Structural Welding Code - Stainless Steel.

1.04 COORDINATION

A. Coordinate Work with other operations and installation of roofing materials to avoid damage to installed insulation and membrane materials.

1.05 ACTION SUBMITTALS

A. Submit under provisions of Section 013000.

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: Layout and erection drawings showing typical cross sections and dimensioned locations of all frames and base supports. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, shape, and patterns.

1.06 INFORMATIONAL SUBMITTALS

A. Design Calculations: 3 copies of structural design calculations for structural components and components resisting wind loads with seal and signature of professional engineer licensed in the State of Texas

B. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Warranties: 3 signed copies.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum five years documented experience in producing pre-manufactured metal-framed equipment screens.

B. Design Qualifications: Provide structural design calculations stamped by a professional engineer licensed in the state in which this project is located.

C. Welders: AWS certified within previous 12 months.

D. Pre-Installation Meeting:
   1. Convene at job site, at least seven calendar days prior to scheduled beginning of construction activities of this section, to review requirements of this section.
   2. Require attendance by representatives of the installing subcontractor (who will represent the system manufacturer), the mechanical subcontractors and other entities affected by construction activities of this section.
   3. Notify Architect four calendar days in advance of scheduled meeting date.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Locate in area designated by Architect.
   2. Construct mock-up, one full screen section wide, including two roof supports.
   3. Do not proceed with remaining work until workmanship, color, and location is approved by Architect.
   4. Remove mock-up if required by Architect.
   5. Accepted mock-up may remain in place.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site clearly marked for proper identification.

B. Receive, handle and store materials in conformance with the manufacturers printed instructions.

C. Store products under cover, in manufacturer's unopened packaging until ready for installation.

D. Protect materials from exposure to moisture.

E. Store materials in a dry, warm, ventilated weathertight location.

F. Protect metal fabrications from damage by exposure to weather.

G. Handling: Use a forklift or crane to move material. Do not lift the bundles by the metal bands.
   1. Fork Lift: Spread the forks as far as possible to balance the load. Drive slowly when moving long bundles over uneven surfaces to avoid tipping the load
   2. Crane: Position the canvas sling straps so that the space between the straps is at least 1/3 the length of the bundle. Use sling straps with looped ends running one end of the strap through the loop at the other end to cinch the bundle when lifted. When setting the load on the roof, put wood blocks under it to protect the roof and allow space to remove the sling straps.
   3. Roof Placement: Spread the bundles and crates out as much as possible to avoid overloading the roof structure. Place the material directly over major supports such as beams or trusses.
   4. Position bundles of tubing parallel to the slope of the roof and block prior to opening to prevent the tubing from rolling down the roof slope when unbundled.

1.09 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. Field Measurements: Verify roof screen dimensions and conditions of the installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. Framing System: Provide manufacturer's standard written one year warranty stating that the complete framing system shall be warranted against structural failure due to cracking, buckling, bending, tearing or corrosion arising under normal use and environmental conditions.

B. Panel Finish:
   1. Provide written warranty stating that the paint finish applied on all equipment enclosure panels will be warranted against chipping, peeling, cracking, fading, or blistering for the coverage period of twenty (20) years.
   2. Provide warranty signed by the panel manufacturer and paint finish applicator (if separate from manufacturer).

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design Loads: Comply with Building Code for site location and building height.
   1. Design to resist ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
   2. Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.

B. Structural Design: Prepare structural design calculations for screen framing and attachment to structure including reactions at base supports for verification of roof structure by Architect.

C. All welds to be performed by an AWS certified welder. Valid certification to be provided.

2.02 MANUFACTURERS

A. CME Screening: www.rooftopscreening.com

B. CityScapes Inc.: www.cityscapesinc.com.

C. Substitutions: See Section 01 6000 – Product Requirements

2.03 MATERIALS

A. Exterior: Screening shall be constructed of high ribbed, color fast, 26 gauge steel siding and trim. 30% siliconized polyester.
   1. Color: Refer to Section 01 6210 Schedule of Materials and Colors.

B. Structure: Welded light weight aluminum custom design to fit each unit's access points with removeable doors.

C. Mounting: Screening structure is supported by roof top unit at each of the four corners. Intermediate supports shall be provided on all sides of screening greater than 140".

D. Free Air Clearance: Free air space at the bottom of the screening shall be a minimum of 3" less than the curb height less applicable roofing.

2.04 FABRICATION

A. Fabricate ends of tubing with flat crimp for connections.

B. Fit and shop assemble items in largest practical sections, for delivery to site.

C. Fabricate items with joints tightly fitted and secured.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

F. Fabricate system components so that portions of screen can be dismantled for repairs to equipment being screened and for future roof replacement.

G. Trim and Closures: Fabricated from 24 gauge metal and finished with the manufacturer’s standard coating system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine area where work will be installed to verify the installation can be performed in accordance with the Drawings and structural calculation requirements without interference from other equipment or trades.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until conditions have been properly prepared.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.

D. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape to eliminate possibility of corrosive or electrolytic action between metals.

E. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.

3.04 CLEANING AND PROTECTION

A. Remove all protective masking from framing and trim material immediately after installation. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Maintain in a clean condition during construction.

B. Protect installed products until completion of project.
   1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.
   2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

D. Replace metal wall panels and framing members that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 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: CREEKWOOD & RIVERWOOD MIDDLE SCHOOLS
HUMBLE INDPENDENT SCHOOL DISTRICT

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 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 09 (Finishes) responsible for but not limited to:

1. Interior finished floor with a coved base at prefabricated cold storage assemblies.

B. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall follow local codes and national standards, except where plans and specifications exceed those codes and standards.

2. 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.

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.

3. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type ‘K’ Copper.

4. Gas Supply Systems with all components and fittings required for a complete system.

5. Water Supply Systems with all components and fittings required for a complete system.

6. Piping and Drainage Systems (Sanitary and grease laden). Systems are to be cleaned before the final connection with food service equipment.

7. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.

8. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.

9. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe thru Grease Trap and/or Interceptor.

10. P-Traps as required (including all disposers).

11. Interconnect water thru Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.

12. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).

13. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).

14. Specified couplings and piping to all equipment furnished by 11 40 00.

15. Pressure Boilers (Size, Provide, and Install unless otherwise specified).

16. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required.

17. Ice Bin Drain Insulation (Provide and Install).

18. Unions at disposer solenoid valves (Provide and Install).

19. 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.

20. Janitor Sink with Faucet (Provide and Install).

21. 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.

22. Exhaust Hood condensate drain connections (Provide and Install).

23. Interconnection of ½” CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker.

24. Fire System Piping. The exposed piping is to be chrome plated.

25. Pipe ½” cold water to swirl inlets at disposers.

26. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

C. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall follow 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, cold storage 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).

   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. Cold air is not 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. Air is not to blow directly on compressors.

10. Mechanical Contractor to locate temperature monitors within return ducts.

11. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

D. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, cold storage 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 alarms.

5. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

6. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).

7. Interconnection between Exhaust Hood fans and switch.

8. Interconnection between Exhaust Hood lights and switch.

9. Cord and plug on equipment that does not have cords/plug (i.e., Braising Pans, Kettles, Ice Machines, Steamers, Combi Ovens, etc.) (Provide and install).

10. Provide waterproof receptacles in wet areas.

11. All electrical connections beneath Exhaust Hoods to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.

12. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.

13. All electrical lighting, power, and distribution systems.

14. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

15. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.

16. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).

17. Adequate lighting at receiving door.

18. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

E. Division 27 (Communication) responsible for but not limited to:

1. Data line coordination for food service equipment.

2. Time clocks.

3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).

F. Division 28 (Electronic Safety and Security) is responsible for but not limited to:

1. Security Cameras as required (Provide, Locate, and Install).

2. Interconnection of Entrapment Panic Alarm for Cold Storage Assembly to the main Building Alarm System that will notify the person designated by the Owner that the Entrapment Panic Alarm has been activated (*Critical*).

G. 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. Provide and Install ¾” Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.

3. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.

4. Washer and Dryer (Provide and Install, unless otherwise specified).

5. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect.

6. 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

B. Furnish certification of regularly manufactured equipment listing or classification by Underwriter's 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. Equipment items or components specified 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 within a common group or category (e.g., refrigerators, kettles, ovens, etc.): 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 cold storage assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.

4. Provide one (1) year parts and labor warranty for all parts of the refrigeration system(s) and cold storage 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. Replacement parts should be of a domestic origin where possible.

1.9 SUBMITTAL DATA

A. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

B. 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

c. Package Three to include (4) Individual sets: 15 Business Days for Review

i. Custom Fabrication

ii. Merchandising Equipment

iii. Miscellaneous Submittals

C. 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 00-5 EXHAUST HOODS

D. Package One (1) requires both submittals: Brochure and Rough-in plans. If not sent together, the submittal will be rejected.

E. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.

F. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.

G. 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.*

H. 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.

I. 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 Cold Storage Assemblies with itemized schedules.

3. Special Conditions Drawings, sizing, and locating the following conditions:

a. Pipe sleeves or roof jacks.

b. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.

c. Blocking grounds or anchor plates required in walls for equipment support/attachment.

d. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.

e. Access panels in walls or ceiling for service of equipment.

f. Ceiling pockets or recesses for unusually high equipment.

g. 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 Cold Storage 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.

J. 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.

K. 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.

L. 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.

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 extent possible, provide two copies of the manufacturer's video instructional 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.

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 _____ **Contact** _____

Architect's Contact Number _____ **Email** _____

General Contractor _____ **PM** _____

G.C. Contact Number _____ **Email** _____

Foodservice Consultant Foodservice Design Professionals, LLC **PM** _____

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, if any, 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 any of the inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

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 _____ **Contact** _____

Architect's Contact Number _____ **Email** _____

General Contractor _____ **PM** _____

G.C. Contact Number _____ **Email** _____

Foodservice Consultant Foodservice Design Professionals, LLC **PM** _____

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, if any, 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 any of the 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. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).

3. Locations of Vacuum Breakers.

4. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.

5. Gas and water line sizes and manifold configurations.

6. Diameter and length of flexible connector lines for fixed/movable gas appliances.

7. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).

8. 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 splash back. 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. T&S HW-6 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: T&S Manufacturer Safe-T-Link “HG-4-SK” Series gas appliance connector: Coated Hose w/NPT Male Ends, Swivel Links, 2-Piece Quick Disconnect, 90° Elbow & Installation Kit. 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 cold storage 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. 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.

3. 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. Cold Storage 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 EMT Watertight. 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 cold storage 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 cold storage 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 vent.

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 service access panel(s) size and placement permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 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. 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.

C. Freestanding tables and all serving counter splash-risers: Turned back at a 90º angle with 1” turndown at the rear.

D. 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.”

E. Tops: 1½” overhang at free sides of underframe or Closed Base Body.

F. 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.

G. Extend underbracing members to the wall, turn down 6”, and anchor to the wall when specified to be mounted on leg/bracket assembly.

H. All openings in tops: 3/16” high raised die-formed edges.

I. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½” deep, secured to the underside of the countertop.

J. All “built-in” and “drop-in” counter equipment/appliances to have framing members at the perimeter of the opening.

2.8 DRAWERS

A. Stainless Steel Liners: Component Hardware Model No. S80-2020 (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: Component Hardware Model No. S83-2020; Refrigerated Drawer: Component Hardware Model No. S81-1520 stainless steel liner.

2.9 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. 14-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.) 14-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, 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.

2.10 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.

2.11 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. 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.

2.12 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.

2.13 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 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.

2.14 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 thru 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 thru tubular support for final connection above the ceiling by Division 26.

2.15 OPEN BASE STRUCTURES

A. 1-5/8" OD x 16-gauge seamless stainless-steel tubing legs beveled 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.

2.16 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.

2.17 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.

2.18 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.

2.19 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.

2.20 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. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection E. Division 23 (Mechanical) for additional information.

2.21 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.

2.22 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.

2.23 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, (713) 892-5001, E-mail: jpgarcia@staffordsmith.com

2. Kirby Restaurant Supply, Mr. Billy Anderson, 809 S. Eastman Road, Longview, Texas 75602, Phone: (903) 757-2723, Fax: (903) 757-9519, Email: billya@kirbyrestaurantsup.com

3. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.com

4. Texas Metal Equipment Company, Mr. Matt Wenzel, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166, E-mail: estimating@tmeco.com

5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (409) 769-1199, E-mail: terry@kommercialkitchens.com

6. Pasco Brokerage, Ms. Kathryn Hollon, 6465 Chase Oaks Blvd., Plano, Texas 75023, (972) 596-3350, E-mail: estimating@pascoinc.net

7. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, (903) 576-6354, E-mail: lewis@afeok.com

8. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: (501) 455-2552, Fax: (501) 455-0802, E-mail: tim@supremefixture.com

2.24 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.

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. Andrew Harman, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (832) 767-5287

3. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.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., cold storage assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job site when directed by the General Contractor and installed/protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.

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 applied General Electric construction sealant Series SE-1200 silicone mastic (silver 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. Startup 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 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. Architectural coordination items for potential Food Service color, material or signage selections:

D. General Architectural finishes:

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: Cold Storage Assembly – Extend kitchen floor flush into Cold Storage Assembly with coved base

5. Furr Downs above Serving Counters

ITEM NO. 902 SHELVING QUANTITY 7

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. Refer to drawings for size, width and lengths.

ITEM NO. 903 REACH-IN FREEZER QUANTITY 2

Manufacturer:	Traulsen
Model:	G-Series
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Anodized aluminum interior and sides S/S exterior front.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. Total of five (5) epoxy coated shelves per section.
6. 6" high adjustable S/S legs.
7. Furnish start-up and Two (2) year free service, including parts and labor.
8. Half height doors hinged as per plan.
9. Five (5) Year compressor warranty.

ITEM NO. 904 REACH-IN REFRIGERATOR QUANTITY 2

Manufacturer:	Traulsen
Model:	G-Series
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Anodized aluminum interior and sides S/S exterior front.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. Total of five (5) epoxy coated shelves per section.
6. 6" high adjustable S/S legs.
7. Furnish start-up and Two (2) year free service, including parts and labor.
8. Half height doors hinged as per plan.
9. Five (5) Year compressor warranty.

ITEM NO. 905 ICE MAKER QUANTITY 1

Manufacturer:	Manitowoc
Model:	UYF-310A
Size and Shape:	Refer to drawings
Alternate:	Hoshizaki

1. Stainless steel bin.
2. Stainless steel legs.
3. Provide Luminice scale inhibitor.
4. Provide size and quantity as required: T&S mofrl #HW-6-48 water quick disconnects installed between filter and ice machine.
5. Cord and plug assembly, coordinate NEMA configuration with electrician.
6. One (1) pre-filter and water filter sized to manufactures recommendations. Mount on wall adjacent to ice machine in an easily accessible location.
7. Special Instruction: 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. 906 CLOTHES WASHER QUANTITY 1

Manufacturer: By GC
Model: ---
Size and Shape: Refer to drawings

ITEM NO. 907 CLOTHES DRYER QUANTITY 1

Manufacturer: By GC
Model: ---
Size and Shape: Refer to drawings

ITEM NO. 908 STUDENT WORK STATION QUANTITY 3

MANUFACTURER: CUSTOM FABRICATED
MODEL: ---
SIZE AND SHAPE: REFER TO DRAWINGS

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides. 4" splash where adjacent to equipment and walls. Counter to be 34" a.f.f..
2. Closed base construction at sink compartments and open base at balance.
3. Stainless steel 18 gauge double panel sides on closed base section.
4. Double pan insulated stainless steel doors at plumbing compartment.
5. Full length 16 gauge S/S undershelf, underhelf to be in removable sections.
6. Adjustable flanged feet at front on open base stainless steel legs.
7. Two (2) 15" x 18" x 10" deep sink compartment. Coordinate location with drain overflow.
8. One (1) T&S model no. B-0320-BB, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections. Locate faucet at beginning of table facing length of table.
9. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece
10. Omit undershelf at floor sink location.

ITEM NO. 909 EXHAUST HOOD QUANTITY 3

Manufacturer: Moduserve,
Model: W-cpb
Size and Shape: Refer to drawings
Alternate: Avtec, Accurex

1. Size and shape as per plan. Exhaust canopy with ceiling mounted plenum box.
2. Hood to meet requirements of local mechanical codes and 2018 IECC Energy Code.
3. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
4. Ventilators to have adjustable make-up air damper which must remain accessible for adjustment
5. All 18 gauge S/S construction.
6. Make-up air fire dampers. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation.
7. S/S filters and grease cup. Provide filter removal tool.
8. 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.

9. Recess mounted LED light fixtures. All exposed fire control piping to be chrome plated and all hood penetrations sealed with S/S escutcheons.
10. 4" air space at rear.
11. S/S back panel where exposed.
12. S/S c-channel closure panel from top of hood to ceiling.
13. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum 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 Fyre Wrap 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.
14. Provide Mod-U-Serve model number ASTS-90 pre-set temperature senor 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° 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° F.
15. Provide minimum 18 gauge stainless steel non-insulated flat wall panel. Extend panels from top of coved base to underside of hood or to top of half wall. Provide with panels, ' T ' type joining strips at interior seams and 'C ' type strips at outside panel ends. Top of panel to be secured to wall with ‘Z’ clips, bottom secured to wall with stainless steel oval head molly bolts Wall panels to extend the full length of the hood wall.
16. Supply plenum located per drawings, coordinate location with GC.
17. 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 flush with ceiling line. 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.

ITEM NO. 910 RANGE QUANTITY 7

Manufacturer:	Garland
Model:	GF36-6R
Size and Shape:	Refer to drawings

1. S/S sides and front.
2. Standard oven with two (2) oven racks.
3. Removable cast iron grates.
4. Removable drippings tray.
5. 3/4" rear gas connections.
6. 10" s/s stub rear.
7. External gas pressure regulator.
8. S/S front end caps and cover plates at front manifold.
9. Casters with brakes.
10. Flame failure and spark ignition on burners and oven.
11. Provide quantities and sizes required&S model no. HG-4Verify-48SK Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.

ITEM NO. 911 S/S WALL CAP

QUANTITY 1

Manufacturer:	Custom fabricated
Model:	***
Size and Shape:	Refer to drawings

1. 14 gauge S/S with 2” turndown on all free sides..

ITEM NO. 912 HAND SINK QUANTITY 4

Manufacturer:	Advance Tabco
Model:	7-PS-50
Size and Shape:	Refer to drawings

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 vavle.
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. 913 WALL SHELVING QUANTITY 6

Manufacturer:	Custom fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	Tabco

1. 16 gauge type 304 S/S, 2" turn down at front and 2" at rear and sides.
2. Mounted 18” above working surface.
3. Stainless steel wall brackets to be mounted no more the 4’ on centers.

ITEM NO. 914 STUDENT WORK STATION QUANTITY 3

MANUFACTURER:	CUSTOM FABRICATED
MODEL:	---
SIZE AND SHAPE:	REFER TO DRAWINGS

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides. 4" splash where adjacent to equipment and walls. Counter to be 34" a.f.f..
2. Open base construction.
3. Full length 16 gauge S/S undershelf, underhelf to be in removable sections.
4. Adjustable flanged feet at front on open base stainless steel legs.
5. One (1) stainless steel wall mounted overshelf, refer to Item No. 913 for construction specifics.

ITEM NO. 915 STUDENT WORK STATION QUANTITY 1

MANUFACTURER:	CUSTOM FABRICATED
MODEL:	---

SIZE AND SHAPE: REFER TO DRAWINGS

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides. 4" splash where adjacent to equipment and walls. Counter to be 34" a.f.f..
2. Closed base construction at sink compartments and open base at balance.
3. Stainless steel 18 gauge double panel sides on closed base section.
4. Double pan insulated stainless steel doors at plumbing compartment.
5. Full length 16 gauge S/S undershelf, underhelf to be in removable sections.
6. Adjustable flanged feet at front on open base stainless steel legs.
7. Two (2) 15" x 18" x 10" deep sink compartment. Coordinate location with drain overflow.
8. One (1) T&S model no. B-0320-BB, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections. Locate faucet at beginning of table facing length of table.
9. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece
10. Omit undershelf at floor sink location.

ITEM NO. 916 STUDENT WORK STATION QUANTITY 2

MANUFACTURER: CUSTOM FABRICATED
MODEL: ---
SIZE AND SHAPE: REFER TO DRAWINGS

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides. 4" splash where adjacent to equipment and walls. Counter to be 34" a.f.f..
2. Closed base construction at sink compartments and open base at balance.
3. Stainless steel 18 gauge double panel sides on closed base section.
4. Double pan insulated stainless steel doors at plumbing compartment.
5. Full length 16 gauge S/S undershelf, underhelf to be in removable sections.
6. Adjustable flanged feet at front on open base stainless steel legs.
7. Two (2) 15" x 18" x 10" deep sink compartment. Coordinate location with drain overflow.
8. One (1) T&S model no. B-0320-BB, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections. Locate faucet at beginning of table facing length of table.
9. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece
10. Omit undershelf at floor sink location.
11. 16 gauge stainless steel wall cap on half wall, 2” turn down at free sides, dead end at full height wall. Field coordinate size, no excessive gaps.

ITEM NO. 918 THREE COMPARTMENT SINK QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings

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) 24" x 28" x 15" deep sink compartments.
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 22304 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 perforated overshelf mounted at 18" above counter top.
8. 18 gauge butt joint wall 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. Special Instruction: 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. 919 EXHAUST HOOD QUANTITY 1

Manufacturer:	Moduserve,
Model:	W-cpb
Size and Shape:	Refer to drawings
Alternate:	Avtec, Accurex

1. Size and shape as per plan. Exhaust canopy with ceiling mounted plenum box.
2. Hood to meet requirements of local mechanical codes and 2018 IECC Energy Code.
3. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
4. Ventilators to have adjustable make-up air damper which must remain accessible for adjustment
5. All 18 gauge S/S construction.
6. Make-up air fire dampers. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation.
7. S/S filters and grease cup. Provide filter removal tool.
8. 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.
9. Recess mounted LED light fixtures. All exposed fire control piping to be chrome plated and all hood penetrations sealed with S/S escutcheons.
10. 4" air space at rear.
11. S/S back panel where exposed.
12. S/S c-channel closure panel from top of hood to ceiling.
13. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum 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 Fyre Wrap 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.
14. Provide Mod-U-Serve model number ASTS-90 pre-set temperature senor 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° 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° F.
15. Supply plenum located per drawings, coordinate location with GC.
16. 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 flush with ceiling line. 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.

ITEM NO. 920 DEMO COUNTER QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides. 4" splash where adjacent to equipment and walls. Counter to be 34" a.f.f..
2. Closed base construction at sink compartments and open base at balance.
3. Stainless steel 18 gauge double panel sides on entire side facing the student work tables at both the closed base and open based sections. Provide recessed duplex receptacle and recessed data connection as shown on electrical drawings.
4. Double pan insulated stainless steel doors at plumbing compartment.
5. Full length 16 gauge S/S undershelf, underhelf to be removable.
6. Adjustable flanged feet at front on open base stainless steel legs.
7. Two (2) 15" x 18" x 10" deep sink compartment. Coordinate location with drain overflow.
8. One (1) T&S model no. B-0320-BB, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections. Locate faucet at beginning of table facing length of table. Provide 18 gauge double panel stainless steel separation panel along back of hand sink and along right side of sink as required by health department codes. Soap and towel dispenser to be mounted on full height wall to the left of the sink.
9. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece
10. Omit undershelf at floor sink location. Also provide an open area near the hand sink for an undercounter garbage can.
11. Provide Two (2) duplex receptacles in counter apron on teacher's side as located on electrical drawings.
12. Provide One (1) load center and closed base housing, All counter and demo equipment to be fed off of load center, Section 11 4000 to pre-wire counter to load center for a single electrical connection by Div. 26.

ITEM NO. 921 STUDENT WORK TABLES QUANTITY 6

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings

1. Top: 14 gauge type 304 S/S with 2" turndown at all sides.
2. Open base construction.
3. 16 gauge S/S undershelf per drawings. Omit undershelf at One (1) of the tables to meet ADA compliance.
4. 5" N.S.F. approved non-marking swivel casters, two with brakes.
5. Two (2) drawer assemblies facing same side.

ITEM NO. 924 WALL SHELVING QUANTITY 1

Manufacturer: Custom fabricated
Model: ---

Size and Shape: Refer to drawings
Alternate: Tabco

4. 16 gauge type 304 S/S, 2" turn down at front and 2" at rear and sides.
5. First shelf to be mounted 18” above working surface with the second tier 12” above that.
6. Stainless steel wall brackets to be mounted no more the 4’ on centers.

ITEM NO. 925 FIRE PROTECTION SYSTEM QUANTITY 4

Manufacturer: Ansul
Model: R102
Size and Shape: Refer to drawings

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.
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".
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. Special Instruction: Install hand held extinguishers, maximum of 3'-2" A.F.F. to top of unit.

END OF SECTION 11 4000

SECTION 11 6623
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basketball backboards, goals, and support framing.

B. Ballet Bars and Brackets

C. Wall mounted protection pads.

D. Volleyball nets and posts.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete floor slab to receive floor sleeves and anchors.

B. Section 05 1200 - Structural Steel Framing: Structural members supporting basketball systems.

C. Section 05 5000 - Metal Fabrications: Secondary structural members supporting gymnasium equipment.

D. Section 09 6466 - Wood Athletic Flooring

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

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; 2017.

E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

B. Electrically Operated Equipment: Coordinate location and electrical characteristics of service connection.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
   1. Electrical characteristics and connection locations.
   2. Structural steel welder certifications.
   3. Manufacturer's installation instructions.

C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gage of metal, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section; utility requirements as to types, sizes, and locations.

D. Erection Drawings: Detailed dimensional requirements for proper location of equipment and court layouts.

E. Submit a copy of the latest UIL rules and regulations verifying compliance

F. Samples: Submit samples of manufacturer's available range of colors, textures, and graphics. Accompanying the submittal described above, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used

G. Operating and maintenance data, for each operating equipment item.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 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 with minimum three years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.

C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Backboard and goal shall have a life-time replacement warranty against breakage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gymnasium Equipment:
   1. AALCO Manufacturing Company; www.aalcomfg.com.
   2. ADP Lemco, Inc.; www.adplemco.com.
   3. Arizona Courtlines, Inc; www.arizonacourtlines.com.
   4. Draper, Inc: www.draperinc.com/sle.
   5. Performance Sports Systems: www.perfsports.com.
   6. Porter Athletic Equipment Company: www.porterathletic.com.
   7. Sports Imports: www.sportsimports.com
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. All equipment model numbers equal to Porter Equipment Co.

B. See drawings for sizes and locations, unless noted otherwise.

C. Where mounting dimensions or sizes are not indicated, comply with applicable requirements of the following:
   1. National Federation of State High School Associations (NFHS) sports rules.
   2. United States Olympic association rules for the sport.

D. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.

E. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

F. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.

G. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.03 BASKETBALL

A. Ceiling-Suspended Backstop Assemblies:
   1. Framing: Center strut; forward folding; rear braced framing
      a. Main Court; model 90917-28
   2. Folding Control System: Electric hoist; Provide each retractable backstop with a model 706 1/2 H.P. for backstops under 28' or model 707 ¾ H.P. winch on backstops 28' & over. Winch and safety strap model 797 and key switch model 791. Refer to Section 08 7100 – Door Hardware for key cylinder.
   3. Height Adjuster: Each backstop shall be provided with line height adjustment unit model 900 to raise/lower assembly by 2 feet to adjust goal height from 8'-0" to 10'-0" A.F.F..
   4. Framing Color: Manufacturer's standard.

B. Backboards: Model 00208-300, 1/2" Tempered glass, rectangular shaped.
   1. Frame: Brushed aluminum edge, steel mounting.
   2. Dimensions: 42 inches high by 72 inches wide
   3. Markings: Integrally manufactured.
   4. Provide model 00-326 safety padding for bottom edge of backboard.
   5. Provide mounting kit.
   6. Color: As selected from manufacturer's standard selection.

C. Goals: Model 00252-500 steel rim, mounted to backboard, with attached nylon anti-whip net; complete with mounting hardware.
   1. Net Attachment Device: Tube-tie.
   2. Finish: Powder coat orange.

2.04 BALLET BARS AND BRACKETS

A. Ballet Bars and Brackets: Fixed brackets with round arm and wood bar where shown on the drawings.
   1. Bar:
      a. 1-3/4" diamenter Red Oak
   2. Brackets:
      a. 9" deep, non-adjustable chrome bracket
      b. Spacing as shown on the drawings but no more than 96" on center.
      c. Coordinate spacing and mounting with mirrors before ordering any materials.
      d. Coordinate mounting height with Owner before installation
   3. Manufacturer
      a. CWF Flooring, Inc.: www.cartwheelfactory.com
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 VOLLEYBALL EQUIPMENT

A. Volley Ball Nets and Posts: Provide court system of adjustable posts, net, and tensioning winch meeting requirements for FIVB, USA Volleyball, NCAA and NFHS competition requirements. See drawings for quanity and configurations required.
   1. Posts: 3 inch O.D. carbon fiber with 1 inch height adjustments between 42 and 96 inches.
      a. Basis of Design: Sports Imports, Model SI-1
   2. Net: 4 inch square #36 nylon cord with vinyl coated polyester hem, double stitched around the perimeter.
      a. Basis of Design: Sports Imports, Model HM50.
   3. Tensioning Winch: Manual crank heavy duty, self-locking worm gear mechanism.
      a. Basis of Design: Sports Imports, Model HDNR-B.
   4. Antenna and boundary marker.
      a. Basis of Design: Sports Imports, Model NA2.
   5. Protective Pads: Polyethylene foam covered with polyester reinforced vinyl fabric.

a. Basis of Design: Sports Imports, Model FP1.

6. Floor Sleeves for Posts: Metal sleeve, with latch cover, cast into concrete subfloor to hold poles for volleyball nets; installed flush with finish floor surface.
   a. Basis of Design: Sports Imports, Model KA25.
7. Official Stand: Stand shall be free standing and shall fold up and have wheels for easy transport with safety bars will be located 30" above the platform.
   a. Basis of Design: Sports Imports, Model PS1.
8. Wall Storage Rack: Rack shall have two concave receptacles for volleyball storage.
   a. Basis of Design: Sports Imports; Model WR10.

2.06 WALL PADDING

A. Wall Padding: Model 00570-1 with foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
   1. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84 as a complete panel.
   2. Flammability: Comply with NFPA 286.
   3. Covering: Vinyl-coated polyester fabric, mildew and rot resistant; stapled to back of board.
      a. Color: As selected from manufacturer's standard range.
      b. Texture: Embossed leather-look.
      c. Fabric Weight: 14 oz/sq yd.
   4. Foam: Open cell polychloroprene (Neoprene) 6 pcf nominal density.
   5. Foam Thickness: 2 inches.
   6. Backing Board: Oriented strand board.
      a. Thickness: 7/16 inch.
      b. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84.
   7. Panel Dimensions: 24 inches wide by 70 inches long, no nailing margins.
   8. Mounting: Removable; Model 00347-100 and 00347-300 mounting hardware. Set wall pads 2" above floor elevation

B. Specially Shaped Padding: Same construction as standard padding; custom fabricate to fit irregularly shaped members, areas, and protrusions in gymnasium as indicated; provide padding for:
   1. Wall corners.
   2. Hand Rail and Guard Rail

C. Round Column Padding: Same construction as standard padding; made to fit; with grommet strip on each long side of pad, provide laces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

D. Verify that electrical services are correctly located and have proper characteristics.

3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.

C. Install equipment rigid, straight, plumb, and level.

D. Secure equipment with manufacturer's recommended anchoring devices.

E. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

F. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration; lubricate equipment as recommended by manufacturer.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 6833
ATHLETIC FIELD EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide various sports athletic equipment as shown on the drawings and/or here-in, including all labor, materials, equipment and incidentals necessary and required for their completion as indicated on the drawings.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 01 of these Specifications.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3000 – Administrative Requirements.

B. Product Data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section;
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
   3. Shop Drawings in sufficient detail to show required anchorage and interface of the work of this Section with the work of adjacent trades;
   4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Shop Drawings:
   1. Submit dimensioned court layouts including:
      a. Equipment locations
      b. Striping width and color
      c. Proposed colored graphic or logo
   2. Submit a copy of the latest UIL rules and regulations verifying compliance.
   3. Provide engineered stamped drawings for backstop systems.
      a. Shop drawing sheets that include engineering information designed by the Contractor’s Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor’s Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

D. Samples: Accompanying the submittal described above, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.04 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.

1.05 WARRANTY

A. The contractor shall furnish a written guarantee warranting all materials, devices, and workmanship to be free of defects for a period of one year from the date of completion and acceptance. Any defects in materials, devices, and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense, and at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. To establish the minimum functional, aesthetic and quality standards, products and product series of the manufacturers listed below are required.

B. Substitutions: Products of other manufacturers are acceptable provided they meet the performance and reliability standards of the recommended equipment. Any substitution to this list must be submitted and approved in writing 10 days prior to the bid date.

2.02 BASKETBALL BACKSTOPS AND SUPPORTS

A. Manufacturers
   1. Porter Equipment Co.: www.porterathletic.com
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Backstop supports shall have the following attributes:
   1. Backstop Supports:
      a. Model # 00176-334.
      b. Mounting Height: 10’-0”
      c. Protective pad: Model #00069-000, 6’ h lace-on pad.
   2. Backstops:
      a. Model # 00234-300 fan shaped cast aluminum backstop, (54” x 39”), painted white with orange outline and target.
      b. Model # 01216-000, removable goal adaptor.
      c. Model # 00202-00 goal.
      d. Model # 601-120, Provide zinc plated chain nets.

2.03 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation. Notify Architect in writing of unsatisfactory or detrimental conditions. Do not proceed until conditions have been corrected. Commencing installation constitutes acceptance of work site conditions.

3.02 INSTALLATION

A. Install in accordance with contract documents and manufacturer's instructions.

B. Install equipment rigid, straight, plumb, and level.

C. Secure all equipment with manufacturer's recommended anchoring devices.

3.03 GUARANTEE - EQUIPMENT

A. The contractor shall furnish a written guarantee warranting all materials, devices, and workmanship to be free of defects for a period of one year from the date of completion and acceptance. Any defects in materials, devices, and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense, and at no additional cost to the Owner.

3.04 PROTECTION

A. Protect installed products until Substantial Completion.

B. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11 6843
SCOREBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-sided LED scoreboards, timers and clocks.

1.02 REFERENCES

A. Standard for Electric Signs, UL-48, 14th Edition.

B. Standard for Control Centers for Changing Message Type Signs, UL-1433, 4th Edition.

C. Standard for CAN/CSA C22.2 No. 207-M89.

D. Federal Communications Commission Regulation Part 15.

E. National Electric Code.

1.03 SUBMITTALS

A. Product data: Submit manufacturer’s product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.

B. Shop drawings: Submit mechanical, electrical drawings, and Structural Drawings sealed by an Engineer familiar with scoreboard design and licensed in the state of Texas.

C. Shop drawing sheets that include engineering information designed by the Contractor’s Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor’s Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

D. Maintenance data: Submit manufacturer’s installation, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Product delivered on site.

B. Scoreboard and equipment to be housed in a clean, dry environment.

1.05 PROJECT CONDITIONS

A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.

B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.

C. Verify mounting structure is capable of supporting the scoreboard's weight and wind load in addition to the auxiliary equipment.

D. Installation may proceed within acceptable weather conditions.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.

B. ETL listed to UL Standards 48 and 1433.

C. NEC compliant.

D. FCC compliant.

E. ETLC listed to CAN/CSA 22.2.

1.07 WARRANTY

A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects.

B. Provide toll-free service coordination.

C. Provide technical phone support during manufacturer's business hours.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The Spectrum Corporation: www.spectrumscoreboards.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN REQUIREMENTS

A. Provide labor, material, equipment and supervision necessary to complete installation of pre-engineered Scoreboard including, but not limited to the following: concrete foundation/piers (for freestanding scoreboards), steel substructure, and Scoreboard support structure. This scope is a performance-based specification. The scope includes all design and installation as required for a complete installation. A full copy of the geotechnical report copy has been included in the project manual. Design shall comply with all applicable codes and accessibility regulations.

B. Design: Conform to AISC Steel Construction Manual and AA Aluminum Design Manual.

C. Applicable Codes: Design and workmanship shall be in accordance with the applicable building code.

D. Design Loads:
   1. Wind Loads: Applicable building code.
   2. Snow Loads: Applicable building code.
   3. Seismic Loads: Applicable building code.
   4. Handrail and Guardrail: 250 lbs. concentrated in any direction.

E. Shop Connections: Welded and capable of carrying stress put upon them.

F. Welding: AWS D1.1.

G. Concrete Foundations: Manufacturer shall design concrete foundation based on applicable loads and geotechnical values provided in the Geotechnical Report. Concrete foundations shall be installed as specified in Section 03 3000.

2.03 INTERIOR SCOREBOARDS

A. Basis of Design: Spectrum Model 5205 single-sided basketball scoreboard for basketball and volleyball displays period time to 99:59, HOME and GUEST scores to 199, PERIOD to nine and indicates possession and bonus. During the last minute of the period, scoreboard displays time to 1/10 of a second.

B. Scoreboard shall have wireless controls with a remote-control board.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.02 INSTALLATION

A. All power and control cables to scoreboards and displays will be routed in conduit. Power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including conduit will be the responsibility of the contractor assigned the scoreboard equipment.

B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.

C. Provide scoreboard and required structure in its entirety

3.03 INSTALLATION-CONTROL CENTER

A. Provide boxes, cover plates and jacks in locations per plans.

B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with Owner's designated representative.

C. Verify earth ground does not exceed 15 ohms.

END OF SECTION

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window shades and accessories.

B. Electric motor operators.

C. Motor controls.

1.02 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

B. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

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.

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.

G. Verification Samples: Minimum size 6 inches 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.

1.05 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 five years of documented experience.
   1. Factory training and demonstrated experience.

1.06 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade complete with selected shade fabric including sample of seam when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up may become part of the final installation.

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
   2. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.
   3. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manually Operated Roller Shades:
   1. MechoShade System, Inc.: www.mechoshade.com
   2. Draper, Inc: www.draperinc.com/sle.
   3. Lutron Electronics Co., Inc: www.lutron.com/sle.
   4. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   5. Levolor: www.levolor.com/commercial/#sle.
   6. Hunter Douglas: www.hunterdouglas.com.
   7. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Motorized Roller Shades, Motors and Motor Controls:
   1. MechoShade System, Inc.: www.mechoshade.com
   2. Draper, Inc: www.draperinc.com/sle.
   3. Hunter Douglas: www.hunterdouglas.com.
   4. Lutron Electronics Co., Inc: www.lutron.com.
   5. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   6. Levolor: www.levolor.com/commercial/#sle.
   7. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

C. Basis of Design: Motorized Shade System
   1. MechoShade System, Inc.: Electro Shade System, Electro/2

D. Basis of Design: Manual Shade System

1. MechoShade System, Inc.: Mecho SlimLine

E. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 WINDOW SHADE APPLICATIONS

A. Shades: Translucent or Blackout as indicated on the drawings.
   1. Type: Roller shades.
      a. Fabric: Refer to Schedule of Materials and Colors.
   2. Color: Refer to Schedule of Materials and Colors.
   3. Mounting: Inside (between jambs).
   4. Operation: Manual and motorized, in locations indicated.

2.03 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
   1. Size: As indicated on drawings.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Flammability: Pass NFPA 701 large and small tests.

C. Roller Tubes: As required for type of operation.
   1. Size: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.

D. Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
   1. Style: Full wrap fabric covered bottom bar, flat profile with closed ends.

E. Manual Operation: Clutch operated continuous loop; beaded ball chain.

F. Motor Operation: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed to UL 325.
   1. Audible Noise: Maximum 39 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
   2. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view.
   3. Motor Type: AC, for direct hardwired connection to AC power source.
   4. Coupling of Multiple Shades: Where possible, minimize number of motors by coupling adjacent shades.
   5. Control Compatibility: Fully compatible with the controls to be installed.

2.04 MOTOR CONTROLS

A. Motorized shades to be controlled by wall-mounted controls as specified below.

B. Control Requirements:
   1. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
   2. Capable of controlling shade speed for tracking within plus or minus 0.125 inch throughout entire travel.
   3. Capable of stopping within accuracy of 0.125 inch at any point between open and close limits.
   4. Capable of assigning shades to groups and subgroups without rewiring.

5. Capable of storing programmable stop points, including open, close, and any other position.
6. Provide power failure memory for preset stops, open and close limits, shade grouping and subgrouping and system configuration.
7. Capable of synchronizing multiple units of the same size to start, stop and move in unison.
8. Provide all components and connections necessary to interface with other systems as indicated.

C. Wall-Mounted Controls: UV stabilized visible parts meeting {\rs\#1}; provided by shade manufacturer.

2.05 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
1. Style: As selected by Architect from shade manufacturer's full selection.
2. Material and Color: To match shade.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.06 FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window sill.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch.
2. Maximum Offset From Level: 1/16 inch.

C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 12 3200
MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured custom plastic-laminate-faced casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.

B. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

C. Section 08 8000 - Glazing: Methods for shop-glazing of casework.

D. Section 12 3600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ANSI A208.1 - American National Standard for Particleboard; 2016.

C. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2016.

D. ANSI/AWI 0641 - Architectural Wood Casework Standard; 2019.

E. ASTM C1036 - Standard Specification for Flat Glass; 2016.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

B. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Component dimensions, configurations, construction details, joint details, attachments and hardware.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances, clearances required, and keying information.

D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 6 inches by 6 inches or as indicated.
   1. Plastic laminate samples, for color, texture, and finish selection, size 6 inches by 6 inches.

E. Samples for Hardware Selection: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Data: Manufacturer's recommendations for care and cleaning.

I. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience and one project within the last five years with a value of woodwork within 20 percent of cost of woodwork for this project.

B. Perform cabinet construction in accordance with ANSI/AWI 0641 - Architectural Woodwork Standards.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
   1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:
   1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 MOCK-UPS

A. Provide full size base cabinet, upper cabinet, and tall cabinet complete with drawers, door, adjustable shelf and countertop of every finish type.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate where directed by the Architect.

D. Mock-up may remain as part of the work.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained finish coating.
   2. Discoloration or lack of finish integrity.
   3. Cracking or peeling of finish.
   4. Delamination of components.
   5. Failure of adhesives.

6. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer shall be members in good standing of the Architectural Woodwork Institute (AWI).

B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

A. Quality Standard: ANSI/AWI 0641 - Architectural Woodwork Standards; 2019.

B. Types: When more than one type is required, see drawings for location of each type of casework.

C. Plastic Laminate Faced Cabinets: Custom Grade.

D. Desks and Display Cases - Premium Grade

E. Refer to 01 6210- Schedule of Materials and Colors and Drawings for additional casework details.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: NHLA; Graded in accordance with ANSI/AWI 0641, Grade II/Custom; average moisture content of 6-8 percent; species as scheduled.

B. Solid Lumber: Any Species, with no defects affecting strength or utility.

2.04 PANEL MATERIALS

A. Plastic-laminate-faced Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of wood plies from any species suitable for intended use unless otherwise indicated, thickness as indicated or as required by application.
   1. Provide 1" thick shelves at storage/book rooms.
   2. Provide 1" thick shelves when length is 36" or longer.

B. Particleboard: ANSI A208.1; medium density industrial type, minimum 45 lb./cu. ft. density, Grade 1-M-2 or better, as specified in ANSI/AWI 0641, composed of wood chips bonded with manufacturer's recommended adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

C. Medium Density Fiberboard (MDF): ANSI A208.2 ; type as specified in ANSI/AWI 0641; composed of wood fibers pressure bonded with manufacturer's recommended adhesive to suit application; sanded faces; thickness as required.
   1. Use for door and drawer fronts.
   2. For doors 6' high and greater use 1" thick material

D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side for horizontal applications, smooth two sides (S2S) for vertical applications; use for drawer bottoms, dust panels, vertical slot dividers, and other components indicated on drawings.

2.05 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Construction: As required for selected grade.

C. Cabinet support bases shall be fabricated from solid lumber.

D. Fabricate all drawers boxes using 1/2" inch, 9-ply laminated hardwood plywood. The top edges of the drawer box sides and back are radiused. Drawer bottom is let in on four sides, and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. Additional bottom braces are used on drawers over 24" wide. All components have one coat of clear waterproof sealer. Drawer boxes are screw-attached to separate drawer fronts.

E. Glazing for Doors: 1/4 inch Clear tempered glass.

F. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.

G. Hardware Application: Factory-machine casework members for hardware that is not surface applied.

H. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.

I. Removable back panels on indicated base cabinets. Provide partial height back panels at sink cabinets.

J. Fixed panels at backs of open spaces between base cabinets.
   1. Provide cutouts for power and data receptacles where indicated on drawings.

K. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

L. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

M. Apron Frames: Construction similar to other cabinets, with modifications.
   1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.
   2. Apron Drawers: Manufacturer's standard drawer construction and size for apron installation. Single drawer for aprons up to 36 inches wide maximum, two drawers for wider aprons.

N. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

O. Countertop Metal Supports: Hidden metal support brackets of size and configuration as required for support of countertops depth as detailed in the drawings.
   1. Manufactures:
      a. Centerline Brackets: www.countertopbracket.com
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 PLASTIC-LAMINATE-CLAD CASEWORK

A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base and tall cabinets.
   1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
   2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
      a. Base Cabinets: 24 inches.
      b. Tall Cabinets: 24 inches.
      c. Wall Cabinets: 14 inches.
   3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.

a. See Section 01 6210 - Schedule of Materials and Colors for products Basis of Design and additional information.
b. Finish: Matte or suede, gloss rating of 5 to 20.
c. Surface Color and Pattern: As scheduled.
d. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
e. Cap exposed plastic laminate finish edges with plastic trim.
1) 3mm PVC, flat shaped; smooth finish; of width to match component thickness
(a) Door and drawer fronts (Color match to face laminate).
(b) Counter top exposed edges (Color match to face laminate).
2) 1mm PVC, flat shaped; smooth finish; of width to match component thickness.
(a) Exposed component edges (Color match to face laminate).
(b) Backsplash and return exposed edges (Color match to face laminate).

2.07 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.08 CABINET HARDWARE

A. Manufacturer's standard types, styles and finishes, and as indicated below.

B. Comply with BHMA A156.9 requirements.

C. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
1. Keying: Key locks alike within a space; key each room separately.
2. Master Key System: All locks operable by master key.

D. Shelves in Cabinets:
1. Shelf Standards and Rests: 4 Standards (K & V)#255, 4 Brackets/Shelf(K & V)#256.

E. Swinging Doors: Hinges, pulls, and catches.
1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
a. Concealed Hinges: Installed in cabinet edge, and on door back, satin chromium plated over nickel on base material.
1) European-Style Hinges, soft close, for Overlay Doors: 120 degree opening angle.
2. Pulls: Satin Chrome wire pulls, 4 inches wide.
a. Pull design to comply with project's referenced accessibility requirements.
3. Catches: Magnetic.

F. Drawers: Pulls and slides.
1. Pulls: Satin Chrome wire pulls, 4 inches wide (typical).
a. Pull design to comply with project's referenced accessibility requirements.
2. Slides: Steel, full extension arms, ball bearings; soft close,capacity as recommended by manufacturer for drawer height and width.

G. Pull-Out Keyboard Tray
1. Each to have:(K & V)#5710

H. Clothes Rod each to have:
1. Rod(K & V)#770 5
2. Flange(K & V)#764 CHR

I. Adjustable Shelves at Display Cases, each to have:
1. Standards (K & V)#87
2. Brackets/Shelf(K & V)#186

J. Casters:

1. Swivel-type: 4-inch diameter wheels of soft or hard rubber and self-lube wheel bearing. Swivel is double-level, hardened ball bearing. All metal surfaces are zinc-plated.
2. Rigid-type: 4-inch wheels of soft or hard rubber, held in horns of formed steel, zinc plated. Wheel spanner bushings. Load capacity is 225 pounds per caster. Brake available on both swivel and rigid.

2.09 MATERIALS

A. Wood-Based Materials:
   1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
   2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

B. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

C. Hardboard: ANSI A135.4, Class 1, tempered.

D. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.
   1. Provide specific types as follows:
      a. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as scheduled, .
      b. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as scheduled, .
      c. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, colors as scheduled, .
      d. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, colors as scheduled, .
      e. Flame Retardant Surfaces: HGF, 0.048 inch nominal thickness, colors as scheduled, .
      f. Cabinet Liner: CLS, 0.020 inch nominal thickness, colors as scheduled, .
      g. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

E. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering; 1/4 inch thick minimum; clear.

2.10 ACCESSORIES

A. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

B. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.

C. Grommets: Standard plastic or rubber grommets for cut-outs, in color to match adjacent surface.

D. Sealant for Use in Casework Installation:
   1. Manufacturer's recommended type.

E. Concealed Fastening Clips: Provide for accessible panels and other areas indicated on the drawings.

F. Cable Management Tray: Size and configuration required for application.

G. Door/Drawer Silencers: 2 per door/drawer minimum, 3 for door/drawers over 48 inches.

PART 3 EXECUTION

3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver casework until the following conditions have been met:
      a. Building has been enclosed (windows and doors sealed and weather-tight).
      b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
      c. Ceiling, overhead ductwork, piping, and lighting have been installed.
      d. Installation areas do not require further “wet work” construction.

B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
   1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inchper story.
   2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.

D. Verify adequacy of support framing and anchors.

E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

F. Secure wall and floor cabinets to concealed reinforcement and blocking at gypsum board assemblies.

G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
   1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches on center, and at sides of cabinets with not less than two fasteners per side.

H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.

I. Install hardware uniformly and precisely.

J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

K. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 12 3551
MUSIC INSTRUMENT STORAGE CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Music Instrument Storage Casework

B. Acoustically Enhanced Music Instrument Storage Casework

1.02 RELATED REQUIREMENTS

A. General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

B. Division 06 Section "Rough Carpentry" for blocking in frame walls required to anchor casework.

1.03 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A208.1 – Particleboard.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
   1. ASTM C 423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E 488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
   3. ASTM E 795 – Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

D. GREENGUARD Environmental Institute (GEI):
   1. GREENGUARD certified low emitting products.

E. Audio Engineering Society (AES):
   1. AES-4id – AES information document for room acoustics and sound reinforcement systems -- Characterization and measurement of surface scattering uniformity.

F. Builders Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.9 – Cabinet Hardware.

G. National Electrical Manufacturers Association (NEMA):
   1. NEMA LD 3 – High Pressure Decorative Laminates.

H. U.S. Department of Commerce, National Institute of Standards and Technology (NIST):
   1. DOC PS 1 – U.S. Product Standard for Construction and Industrial Plywood.

I. California Air Resources Board (CARB).

J. California 93120 – Formaldehyde Emissions Phase I.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s data sheets, installation instructions, and maintenance recommendations.

C. Shop Drawings: Prepared by manufacturer. Include elevations showing casework components, details of each condition of installation, and types and locations of hardware and fasteners. Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other Work.

D. Samples: For each color and finish for each exposed casework component.

E. Operation and Maintenance Data.

F. Warranty: Submit sample meeting warranty requirements of this Section.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in manufacture of similar products in use in similar environments. Obtain music education storage casework through one source from a single approved manufacturer.
   1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time period allowed for substitution review:
      a. Product data, including certified independent test data indicating compliance with requirements for acoustical performance.
      b. Samples of each type of product specified, including but not limited to the following:
         1) Schedule 1 Door and casework panels.
         2) Schedule 2 Grille doors.
         3) Schedule 3 Hinges with through-bolting hardware.
         4) Schedule 4 Latches with through-bolting hardware.
      c. Project references: minimum of 5 installations not less than 5 years old, with owner contact information.
      d. List of successful installations of similar products available for evaluation by Architect.
      e. Sample warranty.
   2. Submit substitution request not less than 15 days prior to bid date. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
   3. Approved manufacturers must meet separate requirements of Submittals Article.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle music education storage casework in accordance with manufacturer’s recommendations. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed and installation areas are ready to accept casework and recommended temperature and humidity levels will be maintained during the remainder of construction.

1.07 COORDINATION

A. Coordinate installation of blocking and supports in frame wall assemblies under work of other sections where required for anchoring of music education storage casework.

B. Project Environmental Requirements
   1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
   2. Do not begin installation until building is completely enclosed and HVAC system is operating and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of 2 weeks.
   3. Maintain continuous and uniform building temperatures of not less than 50 degrees F during installation nor more than 85 degrees F.
   4. Environmental Requirements: Do not install cabinets until all mortar, wet and dust producing work is completed.
   5. Field Measurements: Obtain required field measurements from the Contractor and indicate on Shop Drawings.

1.08 WARRANTY

A. Special Warranty: Manufacturer's written warranty indicating manufacturer’s intent to repair or replace components of music education storage casework that fail in materials or workmanship within 10 years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:

1. Fracturing or breaking of casework components including doors, panels, shelves, or hardware resulting from normal wear and tear and normal use other than vandalism.
2. Delamination or other failures of glue bond of components.
3. Warping of casework components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
4. Failure of operating hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wenger Corporation; www.wengercorp.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINET SYSTEM

A. System Description:
1. Modular instrument storage casework with integral bases, adjustable levelers, and through-bolted fastening, enabling owner reconfiguration of unit layout.
2. Acoustically enhanced instrument storage casework finished with interior lining of sound-absorbent material providing sound absorption and noise reduction properties.

B. Performance Requirements:
1. Acoustically Enhanced Music Instrument Storage Casework Acoustic Properties:
a. Sound Absorption Average: Minimum SAA of 0.80, based upon sound absorption coefficient for twelve one-third octave bands from 200 to 2500 Hz, inclusive, with a minimum Noise Reduction Coefficient (NRC) of 0.75, per ASTM C 423 and ASTM E 795.
b. Acoustical Performance, One-third Octave Band Center Frequency, Hz, for four: 27 by 84 by 29 inch deep (606 by 2134 by 737 mm deep) units:

	125	250	500	1000	2000	4000
Sound Absorption Coefficient						
Mounting Type F65	1.08	0.71	0.86	0.77	0.75	0.68
Sound Absorption, sabins/unit						
Mounting Type F65	68.72	45.25	55.00	48.83	47.85	43.45
Scattering Coefficient						
	0.10	0.13	0.40	0.62	0.80	1.44

2. Storage Casework Component Load Capacities:
a. Storage Casework Wire-Grille Door Hinge: Each weld capable of resisting 400 lbf (1779 N) pull test without visible damage or permanent deformation.

2.03 MATERIALS

A. Particleboard: ANSI A208.1, minimum 45 lb/cu. ft. (721 kg/cu. m) density.

B. Particleboard Thermoset Panels: Particleboard finished with thermally-fused polyester surfacing on both sides meeting performance properties of NEMA LD 3 for VGS grade, edge-banded, including the following:
1. Surface Abrasion Resistance: Taber Wheel, 400 cycles, for solid colors.

C. Polyethylene Shelves: High-density, one-piece, blow-molded or polyethylene, with radiused front edge, for abuse-resistant shelves.

D. PVC Edge Banding: Radiused PVC extrusions, 3 mm thick.

2.04 INSTRUMENT STORAGE CASEWORK

A. General: Provide through-ventilating instrument storage casework meeting requirements in System Description and Performance Requirements Articles.

B. Side Panels and Divider Panels: Particleboard thermoset panel with no urea formaldehyde added, 3/4 inch (19 mm) thick. Side panels machined to accept unit-to-unit through-bolting.

C. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.

D. Grille Doors: Bright basic steel wire, 5/16 and 3/16 inch (7.9 and 4.8 mm) diameter, or 5/16 and 1/4 inch (7.9 and 6.3 mm) diameter for AcoustiCabinets, with full 360 degree welds at T-joints.
   1. Provide for Instrument Storage Casework

E. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.

F. Shelving: Sized with adequate gap between shelving and casework side panels to allow air movement inside casework.
   1. Up to 27 inches (686 mm) wide: Removable molded polyethylene shelf, with impact-resistant, radiused front edge, mounted to cabinet wall with self-locking clip.
   2. Over 27 inches (686 mm) wide: For large instrument casework: Removable formed polyethylene shelf, ribbed, with high-impact-resistant, radiused front edge, supported by steel tube frame.
   3. Corner cabinet revolving shelving: 0.053 inch (1.3 mm) min. thickness steel sheet bolted to revolving steel center post, with radiused hardboard deflector panel.

G. Casework Panel Color: As selected by Architect from manufacturer's standard colors.

2.05 ACCESSORIES

A. Filler Panels and Closure Kits: 3/4 inch (19 mm) thick particleboard thermoset panels with no urea formaldehyde added matching cabinet side panels. Provide the following, cut to fit field conditions, where indicated:
   1. Wall filler between cabinet side and wall.
   2. Top filler between cabinet top and wall.
   3. Top of cabinet closure panel between cabinet and finished ceiling or soffits.
   4. Finished back panel for exposed cabinet backs.

2.06 HARDWARE

A. Butt Hinges: 2-3/4 inch (70 mm), 5-knuckle steel hinges made from 0.090 inch (2.29 mm) thick metal, ANSI/BHMA A156.9, Grade 1, with powder-coated finish, through-bolted to door and side panels and welded to grille door frames. Provide 2 hinges on compartment doors, and 4 hinges on full-height doors.

B. Slide Latch: 0.105 inch (2.67 mm) min. thickness steel, with padlock eye, powder-coat finish, through-bolted to panel door and side panel and welded to grille door frames. Latches securely without padlock. Provide with clear plastic label holder with numbering system. Padlocks furnished by Owner.

C. Panel Connectors: 1/4-20 by 1.77 inch (45 mm) panel connectors, with steel thread inserts, powder coated to match panels.

D. Cabinet Levelers: Leveling glides with 3/8 inch (9.5 mm) diameter threaded steel rod in steel corner brackets, minimum two each per cabinet side, accessible from within unit, and concealed in completed installation.

E. Fasteners: Manufacturer-recommended fasteners as required for casework substrate and project performance requirements, consisting of one or more of the following:
   1. Sheet Metal Screws: SAE J78, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   2. Wood Screws: ASME B18.6.1.
   3. Expansion Anchors in Concrete and Concrete Masonry Units: Carbon-steel, zinc plated.

2.07 FINISHES

A. Steel Sheet, Steel Wire, and Exposed Fasteners: Urethane-based electrostatic powder coating, color as indicated.

B. Refer to Section 01 6210 - Schedule of Materials and Colors for approved color selection.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine casework installation areas for compliance with requirements for installation tolerances, location of blocking and other anchoring reinforcements, and other existing conditions affecting installation and performance of casework. Proceed with casework installation upon correction of unsatisfactory conditions.

3.02 CASEWORK INSTALLATION

A. Install plumb, level, and true; using integral levelers. Install in accordance with manufacturer's recommendations and approved submittals.

B. Install hardware uniformly and precisely. Set hinges snug and flat. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

C. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind and close with uniform reveals.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.04 CLEANING

A. Clean casework surfaces. Touch up, refinish, or replace damaged components in a manner acceptable to Architect.

3.05 PROTECTION

A. Protect work so that it will be without any evidence of damage or use at time of acceptance.

B. Repair or replace defective work as directed by Architect upon inspection.

C. Turn over operation and maintenance instructions to Owner.

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.
   1. Plastic Laminate Countertops.
   2. Solid Surfacing Countertops and Sills.
   3. Natural Quartz Countertops.

1.02 RELATED REQUIREMENTS

A. Section 12 3200 - Manufactured Wood Casework.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2016.

B. ANSI/AWI 0641 - Architectural Wood Casework Standard; 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

F. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation and countertop seaming ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 MOCK-UPS

A. Provide as part of casework specified in 12 3200-Manufactured Wood Casework.

1.06 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 and approved by manufacturer.

B. Perform cabinet construction in accordance with ANSI/AWI 0641 - Architectural Woodwork Standards.

1.07 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.

1.08 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: See Section 12 3200.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Arborite: www.arborite.com/#sle.
         2) Formica Corporation: www.formica.com/#sle.
         3) Lamin-Art, Inc: www.laminart.com/#sle.
         4) Panolam Industries International, Inc\Nevamar: www.nevamar.com.
         5) Panolam Industries International, Inc\Pionite: www.pionite.com.
         6) Wilsonart: www.wilsonart.com/#sle.
         7) Substitutions: See Section 01 6000 - Product Requirements.
      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. Finish: Matte or suede, gloss rating of 5 to 20 or as scheduled in the Schedule of Materials and Colors.
      f. Surface Color and Pattern: See Drawings and Section 01 6210 - Schedule of Materials and Colors.
   2. Exposed Edge Treatment: 3 mm Molded PVC edge with T-spline, sized to completely cover edge of panel.
      a. Color: Color match to face laminate.
   3. Back and End Splashes: Same material, same construction.
   4. Fabricate in accordance with manufacturer's standard requirements.

C. Solid Surfacing Countertops and Sills: Solid surfacing sheet or plastic resin casting self-supporting over structural members.
   1. Flat Sheet Thickness: 1/2 inch, 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) Meganite, Inc: www.meganite.com/#sle.
         5) Relang International, LLC: www.duraseinusa.com/#sle.
         6) Wilsonart: www.wilsonart.com/#sle.
         7) Substitutions: See Section 01 6000 - Product Requirements.

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 20or as scheduled in the Schedule of Materials and Colors.
e. Color and Pattern: As Scheduled.

3. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
4. Back and End Splashes: Same sheet material, 1/2 inch thick maximum, square top; minimum 4 inches high.
5. Fabricate in accordance with manufacturer's standard requirements.

D. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin self-supporting over structural members.
1. Flat Sheet Thickness: 3/4 inch, minimum.
2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic 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) Cambria Company LLC: www.cambriausa.com/#sle.
2) Dal-Tile Corporation: www.daltile.com/#sle.
3) Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
4) Dupont: www.corian.com/#sle.
5) Wilsonart: www.wilsonart.com/#sle.
6) Substitutions: See Section 01 6000 - Product Requirements.
b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
d. NSF approved for food contact.
e. Finish on Exposed Surfaces: See Drawings and Section 01 6210 - Schedule of Materials and Colors.
f. Color and Pattern: As Scheduled.
3. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
4. Back and End Splashes: Same sheet material, 1/2 inch thick maximum, square top; minimum 4 inches high.
5. Fabricate in accordance with manufacturer's standard requirements.

2.02 MATERIALS

A. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
1. 1-1/8" MDF, for tops without sinks.
2. 1-1/8" MDF, meets or exceeds ANSI grade MR10 (moisture resistant) for tops with sinks.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

C. Joint Sealant: Mildew-resistant silicone sealant, color to match counter.

2.03 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.
a. No splices on countertop plastic laminate material less than 144" will be permitted.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.

3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated on drawings.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings and finished as scheduled..

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 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

SECTION 12 6613
TELESCOPING BLEACHERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Telescoping bleachers.

1.02 RELATED REQUIREMENTS

A. Division 01 for Accessible Seating Requirements

B. Section 08 7100 - Door Hardware for door hardware for key cylinder.

C. Division 09 finishes sections for adequate floor and wall construction. Flooring shall be level and rear wall plumb with 1/8” in 8’-0”.

1.03 REFERENCE STANDARDS

A. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures; 2021.

B. PS 1 - Structural Plywood; 2009.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - 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 handling and requirements.
   3. Installation methods.

C. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
   1. Provide drawings customized to this project.
   2. Include Professional Engineer's seal on each sheet.
   3. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.
   4. Graphics Layout Drawings: Indicate pattern of all seat colors.

D. Shop drawing sheets that include engineering information designed by the Contractor’s Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor’s Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.

E. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches in size, illustrating colors and finishes available.

F. Verification Samples: For each custom colored finish, submit samples of actual finish or product, for verification of color selection.

G. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Manufacturer's installation crew.

D. Welder Qualifications: Certified by AWS for the process employed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store, in original packaging, under cover and elevated above grade.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Telescoping Bleachers:
   1. Hussey Seating Company: www.husseyseating.com/#sle.
   2. Interkal LLC: www.interkal.com/#sle.
   3. Irwin Telescopic Seating Company: www.irwintelescopicseating.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TELESCOPING BLEACHERS

A. Irwin Telescopic Seating Company, with plastic seating on Model 4500 steel understructure.

B. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Provide a design certified by a licensed Professional Engineer licensed in Texas.
   2. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
   3. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
   4. Configurations: As indicated on Drawings.
   5. Wheelchair Spaces: Permanent open spaces at locations as per requirements of (ADA) American with Disability Act / (TAS) Texas Accessablity Standards.
   6. Cutouts: Fit units to irregular wall surfaces, columns, pilasters, and other obstructions; take field measurements prior to fabrication.
   7. Operation: Motor operated.

C. Design Loads: Design to withstand the following loading conditions:
   1. Live Load on Structural Supports: 100 psf, minimum, of gross horizontal projection.
   2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot.
   3. Lateral Sway Stress on Structural Supports: 24 pounds per linear foot of seat plank.
   4. Perpendicular Sway Stress on Structural Supports: 10 pounds per linear foot of seat plank.

D. Dimensions:

1. See Contract Drawings for overall dimensions, row count and approximate number of seats requested. Seating supplier shall design and determine the actual number of seats availible based on allowable space and handicap seating reductions required. If actual number of seats differs from that requested, notify the Architect immediatly.
2. Rows: Reference drawings.
3. Rise Per Row: 9 5/8 inches.
4. Row Depth: 26 inches.

E. Structural Supports: Steel or aluminum; manufacturer's standard wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
1. Design so that each row carriage so that it will individually support the design loads and is self supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
2. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
3. Bolting: Use lock-washers or locknuts.
4. Wheels: Minimum 5 inch diameter by 1-1/8 inch wide, with non-marring rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
5. Finish: Manufacturer's standard enamel or powder coating.
6. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.
7. Unlocking: Automatically unlock all rows before engaging retraction mechanism.

F. Motor Operation: Manufacturer's standard drive mechanism, using motor adequately sized for the purpose.
1. Provide UL listed electrical components and wiring.
2. Controls: Start, Stop, Forward, and Reverse in a single control unit.
3. Control Station: Removable plug-in low-voltage pendant station, with first-row plug-in location for each motor.
4. Limit Switches: Automatically stop operation when unit has reached fully open or fully closed position.
5. Provide all wiring internal to bleacher units, to junction box located on back wall; ensure that wiring is not energized except during operation.
6. Electrical Characteristics: 208/230V 5 wire 3-phase, 60 Hz.

2.03 SEAT AND PLATFORM COMPONENTS

A. Seat/Fascia Assembly: Continuous, molded high-density polyethylene plastic, seat minimum 1 inch thick, textured finish, homogeneous color throughout, color as selected from manufacturer's standard selection; approximately 18 inch long sections independently removable with tongue-and-groove or rabbeted interlock at end joints.
1. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.
2. Seat and Row Numbers: Provide recessed pockets and number plates.

B. Platform, Tread, and Step Structure: Plywood continuously supported on front and rear with side joints tongue-and-grooved.
1. Plywood: PS 1, 5-ply southern pine or polyethylene-overlaid douglas fir or southern pine, Grade A-C.
2. Plywood Thickness: 5/8 inch, minimum.
3. Front (Nose), Rear, and Intermediate Supports: Steel channel or tube, hot-dipped galvanized.
4. Provide end caps of same material and finish on each exposed end.
5. Finish: High gloss clear urethane, unless polyethylene finished.
6. Nosings: Formed steel, , minimum, G60/Z275 hot-dipped galvanized.

7. At aisles provide permanently attached intermediate steps of same construction and finish.
8. At bottom of aisles provide step in front of first riser, removable for storage.

2.04 HANDRAILS AND RAILINGS

A. Provide the following railings:
   1. Aisle Handrails: Single post folding railing segment mounted in center of aisle at every other row beginning at row 2.
   2. End of Row Guardrails: Self-storing, at open ends of sections beginning at row 2.
   3. Height: 42 inches above adjacent platform or tread.
   4. Removable Railings: Provide steel post sockets attached to platform supports.

B. Design handrails and railings to withstand the following loads:
   1. Concentrated Load on Handrails: 200 pounds in any direction.
   2. Concentrated Load on Guardrails: 200 pounds in any direction along top rail.
   3. Live Load on Handrails: 50 pounds per linear foot, applied in any direction.
   4. Live Load on Guardrails:
      a. Horizontal: 50 pounds per linear foot, applied at the guardrail height.
      b. Vertical: 100 pounds per linear foot, applied vertically to top of guardrail.

C. Railing Construction: Round steel pipe or tube, self storing, with formed elbows at corners and caps at ends of straight runs.
   1. Provide steel self-storing starting no higher than tier 2, 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4 inch sphere passage requirements..
   2. Material and Finish: Powder coated steel as selected by Architect from manufacturers full line of colors.

2.05 ACCESSORIES

A. Fillers and Closures:
   1. Top Row: Provide seat level rear filler panels to close openings between top row seat and wall; finish to match platforms.

B. Fasteners: Provide hardware and fasteners in accordance with manufacturer92s recommendations.

C. Anchorage: As indicated on drawings; provide hardware in accordance with manufacturer92s recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are consistent with those on the shop drawings.

B. Verify that electrical rough-ins have been installed and are accessible.

C. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not field cut or alter seats, fascia, or structural members without approval.

C. Provide manufacturer's field representative to inspect completed installation.

3.04 ADJUSTING

A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.05 CLEANING

A. Clean exposed and semi-exposed assembly surfaces.

B. Touch up finishes on damaged or soiled areas.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
   1. Location: On site using installed equipment.
   2. Time: As agreed between Owner and Contractor.

3.07 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

SECTION 14 4600
MATERIAL LIFTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Craine Hoist and Trolley.

1.02 REFERENCE STANDARDS

A. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

B. ASME A17.1 - Safety Code for Elevators and Escalators; 2016.

C. ASME B20.1 - Safety Standard for Conveyors and Related Equipment; 2021.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of material lift system with adjacent construction using necessary attachments; provide anchoring devices in accordance with manufacturer's installation instructions; coordinate installation of cast-in-place components.
   1. Electrical System: Coordinate utility and electrical system connections to ensure they are made in an orderly and expeditious manner.

B. Preinstallation Meeting: Conduct preinstallation meeting one week before start of this work on project site; require attendance by affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material descriptions, construction details, component dimensions and profiles, and finishes; include data on rated capacities, electrical and operating characteristics, and necessary accessories.

C. Shop Drawings: Provide plans, elevations, sections, and attachment details; include equipment assembly details with dimensions, weights, loads, required clearances, components, size and location of anchors, required field connections, and methods for field assembly; provide diagrams indicating signal, power, and control wiring.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.05 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 type specified and with at least three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. The contractor shall furnish a written guarantee warranting all materials, devices, equipment and workmanship to be free of defects for a period of one (1) year from the date of completion and acceptance. Any defects in materials, devices, equipment and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense and at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide material lift system as indicated with necessary capacity, size, operation, function, and construction; with safety devices, controls, and accessories complying with applicable standards of 29 CFR 1910, ASME A17.1, and ASME B20.1.

2.02 CRAINE HOIST AND TROLLEY

A. Electric Chain Hoist:
   1. Basis of Design:
      a. DAYTON Electric Chain Hoist.
      b. Substitutions: See Section01 6000-Product Requirements.
   2. Product Details:
      a. Load Capacity: 1,000 lb
      b. Hoist Lift: 20 ft.
      c. Classification: H2.
      d. Number of Speeds: 1.
      e. Lift Speed: 16 fpm.
      f. Motor: HP0.67 hp.
      g. Voltage: 115.
      h. Phase: 1.
      i. Brake: Electric Disc Motor.
      j. Clutch: Overload Limiting.
      k. Control: Push Button Pendant.
      l. Control Cord: 6 ft.
      m. Finish: Powder Coated Red.
      n. Hoist MountHook Mounted - No Trolley.

B. Push Trolley:
   1. Basis of Design:
      a. DAYTON Push Trolley.
      b. Substitutions: See Section01 6000-Product Requirements.
   2. Product Details:
      a. Load Capacity: 1,000 lb.
      b. Fits Beam Height: 3 in to 15 in.
      c. Fits Beam Flange W: 2-3/8 in to 5-5/8 in.
      d. Min. Radius Curve: 18-5/8 in.
      e. Trolley Wheel Dia.: 2-3/16 in.
      f. Wheel Material: Solid Machined Cast Iron.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site dimensions of project construction adjacent to material lift location comply with project requirements; verify on-site measurements before fabrication.

B. Verify that locations for electrical rough-in connections to system equipment are in acceptable locations before installing equipment.

C. Verify that electrical power is available and of correct characteristics.

D. Do not proceed with installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install material lift system and components in accordance with manufacturer's written installation instructions.

B. Install material lift system securely to supporting structure, and flush with adjacent surfaces.

C. Install structural components using methods that comply with requirements indicated relative to layout and structural position.

3.03 ADJUSTING

A. Adjust material lift equipment to operate smoothly and safely.

B. Verify vertical travel of material lift system, and adjust as necessary to maintain operating range indicated.

C. After installation, inspect exposed factory finished material lift equipment, and repair damaged finishes.

3.04 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for additional submittals.

B. See Section 01 7900 - Demonstration and Training for additional requirements.

C. Demonstration: Demonstrate proper operation of material lift system to Owner's personnel.
   1. Use operation and maintenance data as references during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

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.

END OF SECTION

CSP# 2026-08

Huckabee MORE THAN ARCHITECTS

CSP# 2026-06

PROJECT MANUAL – VOLUME 2 OF 2

Creekwood and Riverwood Middle School Additions and Renovations

Humble Independent School District

Humble, Texas

Huckabee | MORE THAN ARCHITECTS

CSP# 2026-06

MORE THAN ARCHITECTS

PROJECT MANUAL

Project Name:	Creekwood and Riverwood Middle School Additions and Renovations – Volume 2 of 2		
Client Name:	Humble Independent School District	Location:	Humble, Texas
Project Number:	1821-13-01,02	Date:	October 29, 2025

All inquiries shall be forwarded to Ross Morgan, Huckabee; rmorgan@huckabee-inc.com; 800.687.1229.

PROJECT TEAM



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END OF SECTION

SECTION 21 0100
FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:

1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11".

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 flyleaf 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 21.
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

SECTION 21 0500
FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:

1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. 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 has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various

lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (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 reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. 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 RECORD DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY
   5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
   6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   7. 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.
   8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
   9. Exact location of all electrical equipment in and outside of the building.
   10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
   11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts

and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 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 operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under

other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
B. Concrete work as specified in Division 3.
C. Concrete pads:
   1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
   2. Chamfer strips at edges and corner of forms.
   3. Smooth steel trowel finish.
   4. Doweled to existing slab
D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 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 plumbing 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 plumbing systems and with the project.
B. Time to be allocated for instructions.
   1. Minimum of 4 hours dedicated instructor time.
   2. 2 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, and 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 Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 21 0510
FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.
B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
    1. Field conditions.
    2. Condition of installation.
    3. Quality of workmanship.
    4. Start-up of equipment.
    5. Testing, adjusting, and balancing of equipment.
B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. 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 a like kind at no additional cost to the Owner.
B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from

plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 0512
FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.
B. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data
C. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.
B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
   1. Actual mechanical equipment and components to be furnished
   2. Service clearance
   3. Relationship to other equipment and components
   4. Roof drains and leader piping
   5. Fire protection piping and equipment
D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26
F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.
B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents
C. Coordinate submittals with requirements of the work and of the Contract Documents.
D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes
I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.
C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number

3. Contractor's name and address
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
a. Contractor
b. Subcontractor
c. Supplier
d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a re-submittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 0513
ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:

1. Motors for fire protection equipment.
2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.

D. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.

E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for fire protection equipment manufactured by one of the following:

1. Baldor Electric Company.
2. Century Electric Div., Inc.
3. General Electric Co.
4. Louis Allis Div.; Litton Industrial Products, Inc.
5. Lincoln Electric
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:

C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.

1. Frames. NEMA #56.
2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer’s instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 21 0514
FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor’s responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse, or abandon.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
G. Clean and repair existing materials and equipment that remain or are to be reused.
H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.
B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
D. Remove and replace existing fire protection systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
F. Remove and replace existing piping coincident with the construction.

3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK

A. The Contractor shall modify, remove, and/or 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 the property of the Owner and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation, and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
B. All items 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 relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be

repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing fire protection installation, or as specified.

H. Existing fire protection piping, and devices found to need additional hangers installed shall be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing equipment in renovated areas as specified in Section 21 05 00 Fire Protection General Provisions.

END OF SECTION

SECTION 21 1000
FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs, and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.

B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.

C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.

D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor’s detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.

E. Do not exceed 52,000 square feet of building for each individual sprinkler system.

F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20

G. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.

H. Study the general, structural, electrical, and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

I. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.

B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state, and federal fire authorities.

B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.
B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
D. Provide ¼ scale drawings to show the location of the water entry into building with all zone valves, and shut-off valves, with alarms and drains at this location. Prepare the sprinkler drawings under the work of this Section.
E. Submit samples of all sprinkler types for approval.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Johnson Controls (Tyco Fire Products)
    1. Gem/Grinnell
    2. Central
    3. Star Sprinkler
B. Automatic Sprinkler Company of America
C. Potter Roemer, Inc.
D. The Reliable Automatic Sprinkler Company
E. Viking Corporation
F. Victaulic Company of America
G. Globe Fire Sprinkler Corporation

2.2 PIPING AND FITTINGS

A. Above Slab Inside Building
    1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
    2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
        a. Light wall having a minimum corrosion resistance ratio (CRR) or 1.00 or greater.
        a. Schedule. 40, black steel pipe joined with rolled grooved fittings.
B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.
C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.
D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance with the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

2.3 SPRINKLER HEAD

A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice

size.

B. All heads shall be UL listed and/or FM approved and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with “O” ring design shall not be acceptable.

C. Exposed areas:
   1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
   2. Tyco Model B, FRB, Globe Model GL-QR, GL-SR, or approved equal

D. Sidewall applications:
   1. Horizontal sidewall type with brass finishes and chrome escutcheon.
   2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
   3. Tyco Model B, FRB, Globe Model GL-QR/SW, GL-SR/SW, or approved equal.

E. Suspended ceilings:
   1. Adjustable drop-down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
   2. Color of plate, selected by Architect
   3. Tyco Series RFII; Series ELOC, Globe Concealed Models GL-QR/INCH, GL-SW/INCH and GL-INCH/ECLH or approved equal.

F. Dry sprinklers heads at freezers and coolers
   1. Tyco Model DS-1, DS-2, or approved equal.

G. Correctional Cells:
   1. Suspended jail cell ceilings:
      a. Quick response, institutional applications
      b. Standard coverage for Light Hazard and Ordinary Hazard Occupancies
      c. Extended coverage for 16’ x 16’ Light Hazard occupancies
   2. Reliable Model XL Standard and Quick Response Pendent and Horizontal Sidewall Sprinklers. Coordinate all Sprinkler Head finishes with Architect.

H. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed heavy duty bolt on guards. Bulb type sprinklers will not be acceptable for these locations.
   1. Storage rooms with exposed structure.
   2. Gymnasiums.
   3. Mechanical and Electrical rooms.
   4. Below exposed stairs.
   5. Exposed structure areas.

I. Systems serving walk-n freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer’s recommendation with respect to freezer ambient temperatures expected.

2.4 INSPECTOR’S TEST CONNECTION

A. Provide inspector’s test connection as required by NFPA 13.
   1. Ductile iron module housing with combination sight glass, orifice, and bonnet assembly
   2. UL listed
   3. Victaulic No. 718
   4. Globe Model UTD
   5. Tyco, or approved equal

2.5 TAMPER SWITCH / SUPERVISORY SWITCH

A. Tamper switch on each valve
   1. Controlling or shutting off sprinkler system or any portion thereof.

2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
3. Switch shall be compatible with installed valve for standard mounting.
4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.6 FLOW SWITCH

A. Vane type flow switch.
1. Self-contained pneumatic, adjustable retard.
2. Two, single pole, double throw switches.
3. Red enamel tamper proof switch housing with flow paddle.
4. Potter Roemer Model No. 6200 or approved equal.

2.7 FLOORS AND CEILING PLATES

A. 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.

2.8 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

2.9 DRY PIPE SYSTEM

A. General: Provide a UL listed, and FM approved dry pipe system at the dock area. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.
B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756, Globe Model RCW.
C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.
D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.
E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.
F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.
G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.
H. Provide an accelerator when system capacity exceeds 500 gallons.
I. Provide a water motor alarm or electric pressure switch.
J. Provide dry pipe valve trim and pressure gauges.
K. Dry pipe system shall be hydraulically calculated for the hazard being protected.
L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.
M. Provide a test drain valve sized per NFPA. An inspector’s test shall be provided at each system.
N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.
O. The following accessories shall be provided where required:
1. Victaulic Series 756.
2. Viking Model E dry pipe valve with conventional trim.
3. Viking Model D-1 accelerators.
4. Globe Model RCW dry pipe valve with conventional trim package, and Model C

Accelerator.

2.10 GASKETS

A. Use 1/16-inch-thick preformed synthetic rubber bonded.

2.11 COUPLINGS

A. Use listed rolled grooved mechanical couplings to engage and lock grooved, or shouldered pipe ends and to allow for some angular deflection, contraction, and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.12 VALVES

A. Use valves suitable for 175 psig WOG.

B. Valves to be UL listed and FM approved.

C. Valve Connections:

1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
2. Screwed ends for pipe sizes 2 inches and smaller.
3. Flanged ends for pipe sizes 2-1/2 inches and larger.
4. Solder or screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

D. Gate Valves:

1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.

E. Check Valves:

1. Up to 2-inch, bronze, regrind bronze swing disk, solder, or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
2. Over 2-inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or approved equal.

F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.

G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

2.13 ELECTRIC ALARM BELL

A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

2.14 GAUGES

A. Gauges shall be bourdon tube type with minimum 4-1/2-inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.

B. Gauges shall have ¼ inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.

C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.

D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.

E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.

F. Manufactured by:
   1. Trerice Model No. 4500 Series
   2. Ashcroft
   3. Marsh
   4. Weksler

2.15 SPARE SPRINKLER HEAD BOX

A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.16 ALARM CHECK VALVE

A. Provide UL listed check valve.
   1. Variable for City Supplied systems pressure trim set.
   2. Constant for Fire Pump Systems pressure trim set.
   3. Tyco AV-1, Globe Model H, or approved equal.

2.17 WATER MOTOR ALARM

A. Provide a red enamel motor alarm for installation on exterior wall.
   1. Tyco Model WMA-1, Globe Model WM, or approved equal.

2.18 SIAMESE FIRE DEPARTMENT CONNECTION

A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
   1. Provide a 4" X 2-1/2" x2-1/2".
   2. Potter-Roemer #5751

PART 3 - EXECUTION

3.1 DESIGN

A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.

B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C. Friction losses in pipe will be based on a value of “C” = 120 in the Hazen and Williams formula.

D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting, or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.

B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.

C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” on center, minimum 6 inches and maximum 12 inches from glazing.

E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

3.3 PREPARATION

A. Ream pipes and tubes, clean off scale, rust, oxide, and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Pipe beveled each end, per approved procedures.

C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.4 CONNECTION

7A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.

C. Clamp cast iron water pipe at fittings with ¾ inch rods and properly anchor and support.

D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.

B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.

C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose

only heads.

B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.

C. Locate system drains and inspector's test connections in utility rooms, mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.

D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.

E. Locate outside alarms on wall of building and coordinate with Architect.

F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.

G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.

H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings.

I. Provide Easy-Flex or Flexhead Industries sprinkler hose fittings for each sprinkler head installation for hydraulically designed wet, pre-action, deluge, or dry pipe sprinkler connections per NFPA 13. Allow a 3" minimum bend radius per UL.

J. Install pipe markers to identify fire protection.

K. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.

L. Install fire 2-1/2-inch department valve, maximum 5 feet above floor, complying with NFPA 14.

M. During construction, make one standpipe outlet available on each floor without delay, for fire department use.

N. Provide 3-way standpipe outlets above roof.

O. Provide pressure gauges at the top of each standpipe as detailed on the drawings.

P. Provide drain for each standpipe.

Q. Install valves with stems upright or horizontal, not inverted.

R. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.

S. Install the complete fire sprinkler system in accordance with the approved shop drawings.

T. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish, and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.

U. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.

V. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).

W. Do not install exposed piping below structure in public area.

X. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

3.8 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction.

Use approved adjustable ring type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved adjustable ring type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

3.9 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable ring type hangers shall be used for single pipe supports; Erico Model 115 NFPA UL/FM. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. All parts shall be zinc plated carbon steel, or galvanized.

3.10 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16-gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and airtight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for

the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.11 CLEANING OF PIPING SYSTEMS

A. 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.

3.12 FLUSHING AND TESTING

A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.

B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.

C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.

D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.13 EXCAVATING, TRENCHING, AND BACKFILLING

A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows, and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows, and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
   1. Both sides of penetrations through walls, floors, and ceilings.
   2. Close to valves or flanges.
   3. Intervals on straight pipe runs not to exceed 50 feet
   4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

3.15 TESTING AND ACCEPTANCE

A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.

B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.16 TRAINING

A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner’s designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner’s Operation and Maintenance Manual prepared for this

project shall be used during the instruction.

END OF SECTION

SECTION 22 0100
PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:

1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2 inch x 11 inch.
   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 flyleaf 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 22.
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.
10. Provide gas piping pressure test reports.

END OF SECTION

SECTION 22 0500
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:

1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. 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 three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned

locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain three sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (two sets are for the Owner's use and one set is for the Architect / Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. 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 RECORD 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 elevation.
   7. Indicate exact location of all underground plumbing piping and elevation.
   8. Indicate exact location of all underground electrical raceways and elevations.
   9. Correct schedules 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 plumbing 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.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or

above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 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 operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
B. Concrete work as specified in Division 3.
C. Concrete pads:
   1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
   2. Chamfer strips at edges and corner of forms.
   3. Smooth steel trowel finish.
   4. Doweled to existing slab
D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.
C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 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 plumbing 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 plumbing 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, and 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 Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect / Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 22 0510
PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.
B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
    1. Field conditions.
    2. Condition of installation.
    3. Quality of workmanship.
    4. Start-up of equipment.
    5. Testing, adjusting, and balancing of equipment.
B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. 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 a like kind at no additional cost to the Owner.
B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from

plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 0511
UNDER SLAB PIPE VOID SYSTEMS

PART 1 - GENERAL

1.1 OVERVIEW:

A. This specification covers Sacrificial Pipe Void Forms, hereinafter referred to as “Pipe Voids”. Saddle Pipe Voids and Standard Pipe Voids shall always be used in conjunction with SV – Rigid/Rib Retainers as a SYSTEM to maintain void spaces below all building utility systems under building foundations during and after construction.

B. Pipe Voids serve as sacrificial falsework, which isolate critical building systems, such as domestic water, fire water, sanitary sewer utility pipes, electrical, communication conduits, and other building system piping from the potentially damaging effects of expansive soils. The Pipe Voids furnished for this project shall be in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or as established by the Engineer.

C. The Pipe Voids shall be resistant to water and UV rays and shall be chiefly comprised of carbon steel expanded metal, which is structurally efficient and biodegradable. The carbon steel shall contain a minimum of 40% RECYCLED material. In situations where two or more specifications apply to this work, the most stringent requirements shall govern.

1.2 PIPE VOID STRUCTURE:

A. Pipe Voids shall provide a dimensionally stable void space, maintaining uniform separation between the base soil and the critical building systems. The Pipe Voids shall have sufficient structural strength to maintain the intended void space while experiencing the anticipated construction loads.

B. The Pipe Void (system) shall be designed to perform as sacrificial falsework and shall remain in place after construction and shall not be reused.

C. Serving as a structural fuse, Pipe Voids shall intercept the potential accumulation of vertical and lateral soil forces on critical building utility systems which can result from soil movement. The Pipe Voids shall intercept, absorb or redirect the forces of soil movements by: crumpling, crushing, collapsing, deforming, material section degradation, soil extrusion, open corrugation load span designs or combination of any or all load relief design functions.

1.3 SUBMITTALS

A. The manufacturer’s literature shall be submitted prior to installation.

B. Submittal Drawings shall indicate layout, components and material sizing. Include information on all components and accessories.

C. Submittals shall include a full copy of these specifications with a line-by-line compliance as required for all mandatory shop drawings. Refer to Specification 22 05 12 Plumbing Shop and Coordination Drawings.

1.4 PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.5 Related Specifications

A. 22 11 16 Domestic Water Piping and Appurtenances

B. 22 13 16 Soil Waste & Sanitary Drain Piping, Vent Piping and Appurtenances

C. 22 14 13 Roof Drainage Piping & Appurtenances

D. 22 20 00 Plumbing Pipe and Fittings General

PART 2 - PRODUCTS

2.1 PIPE VOID MATERIAL:

A. Pipe Voids shall be constructed from Carbon Steel Expanded Metal, Types I & II, conforming to ASTM F1267 and shall be assembled when required with 16ga. galvanized steel -Rings.

B. The carbon steel shall conform to ASTM A1011 and contain a minimum of 40% RECYCLED material.

C. All expanded metal components used for the manufacture of any Pipe Void shall fully conform to EMMA (Expanded Metal Manufacturers Association) minimum material standards.

D. All assembly and/or fabrications of the Pipe Voids shall occur entirely within the United States.

E. The Pipe Void material shall not promote the formation or emergence of mold spore, organic or other biological colonization.

F. The Pipe Voids must be able to be delivered and stored unprotected in the open jobsite environment for a minimum of 90 days without loss of design strength.

2.2 PIPE VOID MATERIAL, MINIMUM PHYSICAL PROPERTIES REQUIREMENTS:

A. Pipe Void shall be naturally waterproof in terms of its intended use in this section.

B. Pipe Void shall have negligible buoyancy.

C. Pipe Void shall maintain structural integrity in 100% relative humidity.

D. Pipe Void material shall not emit offensive off-gassing odors during decomposition.

E. The structural integrity of the Pipe Void shall be unaffected by high/low ambient temperatures and elevated surface temperatures from direct sunlight extremes, above or sub-freezing, frozen soil and ice buildup.

F. Pipe Void must have an industry history of providing consistent performance integrity during and after all types of weather event applications, while in readiness storage or installed, without the threat of partial or full section premature collapse during backfill or concrete casting operations.

G. Pipe Void strength shall not be affected by becoming damp, wet, or when completely submerged in standing water.

H. Pipe Void must be fire-resistant and incombustible.

I. All Suspension Hardware to be Stainless Steel Grade, including nuts, washers & hanger rods.

J. All Suspended Piping using the Pipe Void Systems, must be permanently fixed to and permanently suspended but supported at constant elevations by structural components above.

K. All Pipe Void System protection component materials excluding hanger hardware, backfill, piping or conduits shall be furnished per project specifications by SV-PV system manufacturer.

2.3 PIPE VOID MATERIAL, MINIMUM PERFORMANCE REQUIREMENTS:

A. The Pipe Void (system) shall be designed to provide sufficient dynamic live and dead load support capacities of but not limited to all loads common to this type of construction.

B. Installation of utility piping and/or conduit – dead/live loads, Placement of backfill materials.

C. Manpower and foot traffic loads after application of substrates, do not Walk on Void components without Substrates in place.

D. Sub-standard Pipe Void cover sheet substrates, can affect desired performance; use only the types of substrates as those approved for use and recommended by the Pipe Void (system) manufacturer.

E. Substrate materials shall originate from FSC (Forest Stewardship Council, United States) mills and be in new or like new condition, performing to APA (The Engineered

Wood Association) current standards.

2.4 RIGID RETAINER STRUCTURE:

A. Rigid Retainers shall maintain a dimensionally stable void space beneath structural concrete and other critical building systems and components by physically restraining backfill material from entering the void space. The Rigid Retainers shall have sufficient structural strength to maintain the intended void space, without excessive deflection, while experiencing the anticipated lateral earth pressures.

B. The Rigid Retainers shall be designed to perform as a permanent soil retaining structure which shall remain in place after construction and shall not be reused.

C. For “Best Practice Standards,” the Rigid Retainers recommended installation is to overlap concrete castings by at least six (6) inches and extend a minimum of at least six (6) inches into the subgrade.

D. Rigid Retainers should be secured to the concrete at the top with at least three (3) anchors of sufficient size and securing strength, one at each end of the overlapping joint seal design and one centered.

E. A “Minimum Design Standard,” for the Rigid Retainers shall be designed to overlap concrete castings by at least three (3) inches and extend a minimum of at least three (3) inches into the subgrade.

2.5 RIGID RETAINER MATERIAL:

A. The Rigid Retainers shall be constructed from extruded or injection molded High Density Polyethylene (HDPE).

B. The HDPE material shall be either HDPE-8 (Crate Grade) or HDPE-8 (Pail Grade) and shall contain a minimum of 95% RECYCLED material. (5% for colorant and plastic foaming additives)

C. The HDPE shall conform to the following: ASTM D 1238 or ASTM D 1238E, ASTM D 4883

D. ASTM D 638, ASTM D 790, ASTM D 256, ASTM D 2240 and ASTM D 648.

E. Rigid Retainers shall be manufactured entirely within the United States.

2.6 RIGID RETAINER MATERIAL, MINIMUM PHYSICAL PROPERTIES REQUIREMENTS:

A. Rigid Retainer shall be naturally waterproof in terms of its intended use in this section.

B. Rigid Retainer shall have negligible buoyancy.

C. Rigid Retainer shall maintain structural integrity in 100% relative humidity.

D. Rigid Retainer material shall be non-biodegradable.

2.7 RIGID RETAINER MATERIAL, MINIMUM PERFORMANCE REQUIREMENTS:

A. Rigid Retainers material shall provide sufficient dynamic live and dead load support capacities of but not limited to all loads common to this type of construction.

1. Installation of backfill material – construction live loads
2. Manpower and foot traffic loads
3. Rigid Retainers material shall possess sufficient structural strength to resist anticipated lateral earth pressures.
4. Rigid Retainers must be able to be delivered and stored unprotected in the open jobsite environment for a minimum of 90 days without loss of design strength.
5. The structural integrity and installation of the Rigid Retainer shall be functionally unaffected by high/low ambient temperatures and elevated surface temperatures from direct sunlight extremes, above or sub- freezing, frozen soil and ice buildup.
6. Rigid Retainer material strength shall not be affected by becoming damp, wet, or when completely submerged in standing water.
7. These Rigid Retainer general specifications, with recommended application height and position adjustments, also apply to other Rigid Retainer assemblies such as, **SV** – Pipe Void Systems.

2.8 INSTALLATION, QUALITY CONTROL:

A. During Installations, follow fully all Pipe Void System manufacturers' installation instructions.

B. Installations are subject to inspection by the Pipe Void System Manufacturer, their designated authorized personnel or representatives, for installation compliance and overall quality control.

2.9 APPROVED PIPE VOID MANUFACTURERS MEETING ALL REQUIRED SECTION SPECIFICATIONS:

A. SuperVoid Systems, LLC -
   1. 1172 County Rd. 24 - Prattville, Alabama 36067 –
   2. 334-730-3614 - 334-221-5761
   3. Lprimm@SuperVoid.com; primmd@SuperVoid.com
   4. www.SuperVoid.com

B. Plumbing Void Pipe Isolation System
   1. Void Form Products, Inc.
      a) 6151 Cowley Road - Fort Worth, TX 76119 - 888-803-VOID (8643) - 817-429-0888 (Local)
      b) http://voidform.com

END OF SECTION

SECTION 22 0512
PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data

C. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼ inch = 1 foot - 0 inch.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
   1. Actual mechanical equipment and components to be furnished
   2. Service clearance
   3. Relationship to other equipment and components
   4. Roof drains and leader piping
   5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.
B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents
C. Coordinate submittals with requirements of the work and of the Contract Documents.
D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes
I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name and address

4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
a. Contractor
b. Subcontractor
c. Supplier
d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a re-submittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect/Engineer will:

1. Review identified submittals with reasonable promptness and in accordance with schedule
2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 0513
ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:

1. Motors for plumbing equipment.
2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.

D. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.

E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for plumbing equipment manufactured by one of the following:

1. Baldor Electric Company.
2. Century Electric Div., Inc.
3. General Electric Co.
4. Louis Allis Div.; Litton Industrial Products, Inc.
5. Lincoln Electric
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:

C. Temperature Rating. Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for ¾ hp and larger, and provide capacitor-start single-phase motors for ½ hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide two separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.

1. Frames. NEMA #56.
2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer’s instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 0514
PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
G. Clean and repair existing materials and equipment that remain or are to be reused.
H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.
B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
F. Remove and replace existing piping coincident with the construction.
G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.
H. Relocate all domestic piping as required to accommodate new work requiring precedence.
I. Remove concrete housekeeping pad where materials or equipment have been removed.
J. Remove all known utilities that do not provide service to the buildings that remain.
K. Remove existing plumbing vent penetrations through roof not to be reused.

3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

A. The Contractor shall modify, remove, and/or 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 the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items 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 relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.

H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION

SECTION 22 0515
PLUMBING EARTHWORK

PART 1 - GENERAL

A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.

B. Cut the bottom of the trench or excavation to uniform grade.

C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.

D. 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.

3.2 BACKFILL

A. 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.

B. 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 8 inch maximum layers, loose measure. Compact to not less than 95 percent of maximum soil density as determined by ASTM D-698 Standard Proctor.

C. 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.

D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.3 DISPOSAL OF EXCESS MATERIAL

A. 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 the Owner/Architect.

END OF SECTION

SECTION 22 0516
EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE BUILDING SLAB

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
B. Refer to Instructions to Bidders for substitution of materials and products.
C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.
B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork
B. Water Distribution
C. Sanitary Sewer
D. Plumbing

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
   2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
   4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
B. City Standards
C. Local Governing Agencies
D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.
B. Sand: Clean, local sand
C. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:

1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.

B. Storm and Sanitary Sewer Trenches:
1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

C. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.

D. Water Line Trenches:
1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.2 PIPE BEDDING AND BACKFILL

A. Storm and Sanitary Sewer Trenches:
1. The cement-stabilized sand bedding shall not extend from a point 6 inches below the bottom of the pipe to the level of the spring line. This material shall not be used after it loses its moisture content.
2. The cement-stabilized sand shall be thoroughly rodded after being placed in the trench.
3. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill shall be placed to one foot above the top of pipe for earth backfill and 6 inches over the top of pipe for cement-stabilized sand backfill.
4. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
5. Backfill shall be placed in uniform layers not to exceed 8 inches loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D698).
6. Backfill, under pavement and to one foot from outer edge, shall b e cement-stabilized sand, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 5 above and stabilized where required.

B. Water Line Trenches:
1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95 percent Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill

placed in uniform layers not to exceed 8 inch loose depth. Each lift shall be compacted to a minimum of 90 percent of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.

C. Natural Gas Trenches:
   1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
   2. Natural gas lines shall not be installed in trenches with other utilities.

D. Utility Locators:
   1. Provide metallic locator over all underground utilities, including irrigation piping, plumbing, control wiring, conduit, data, etc. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION

SECTION 22 0517
PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames
B. 14-gauge steel panels
C. Continuous fully concealed hinges
D. Flush screwdriver cam lock & cylinder lock for Owner selection
E. Prime coat finish
F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors
B. 16-Gauge stainless steel
C. 20-Gauge insulated sandwich-type door panel.
D. Two inch thick with fire rated insulation
E. Continuous fully concealed hinge
F. Automatic closing and latching mechanism
G. Knurled knob and recessed key operation for Owner selection
H. Interior latch release slide for opening from inside
I. Prime coat finish
J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor
B. MIFAB
C. Acudor
D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
B. Installation shall be in accordance with the manufacturer’s printed instructions.
C. Minimum size required:
    1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items in ceilings
    2. 8 inch x 8 inch for plumbing for single isolation valve or shock arrestor

END OF SECTION

SECTION 22 0519
PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

A. Division 22, Plumbing
   1. Plumbing General Provisions
   2. Pipe and Pipe Fittings, General
   3. Valves, Strainers and Vents

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

A. Trerice
B. Taylor
C. Marsh
D. Weksler
E. Marshalltown
F. Weiss
G. Miljoco

2.2 PRESSURE GAUGES

A. Case and Ring: 4 inch type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
B. Dial: White aluminum with black markings
C. Window: Clear acrylic
D. Tube: Phosphor bronze and forged brass socket.
E. Gauge accuracy: +/- 1 percent over operating range.
F. For pulsating service, provide impulse dampers.
G. Without flange for pipe mounting.
H. With flange for wall mounting.
I. Weiss Model: Domestic Water 4CTS LF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
D. Wells shall be sized to extend a minimum of 50 percent into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

A. Die cast aluminum case with baked epoxy finish.
B. Adjustable angle 9 inch scale length.
C. Clear acrylic window.
D. Brass stem, length to match well.
E. Red reading organic spirit filled-in magnifying glass column.
F. White background with black figures and markings.
G. Brass stems and union connections (Lead Free).
H Accuracy: +/- 1 percent of scale range.
I. Range:
   1. Hot water lines: 30 deg. F to 240 deg. F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with drawing details and manufacturer's recommendations.

B. Provide a ball valve at each gauge (Lead Free).

C. Locate gauges and thermometers to be easily readable from the floor at a 5 foot-6 inch eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.

D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.

E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.

1. Hot water lines: 30 deg. F to 240 deg. F.
2. Tempered water valves 0 deg. F to 120 deg. F.

END OF SECTION

SECTION 22 0523
VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing Valves
B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
   1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
   2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.

B. Butterfly Valves
   1. Butterfly valves shall conform to MSS-SP67.
   2. Liners, inserts and discs shall be suitable for the intended service.
   3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
   4. All valves for domestic use must be lead free.

C. Balancing Valves
   1. Provide balancing valves with:
      a. Corrosion resistant plug with resilient seal when required.
      b. O-ring stem seal.
      c. Permanently lubricated, corrosion resistant bearings.
   2. Connections
      a. Through 2 inch pipe size use threaded connections.
      b. For valves 2-1/2 inch pipe size and larger shall be provided with 150 psig flange connections.
   3. Provide each valve with:
      a. Memory stop.
      b. Plastic drip cap.
      c. 1/8 inch gauge tap.
   4. All valves for domestic use must be lead free.

D. Ball Valves
   1. Provide ball valves with:
      a. Blowout proof stem.
      b. Full size port, 316 stainless steel ball and stem.
      c. Cast bronze body.
      d. Threaded ends.
   2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
   3. Service rating:
      a. 150 psi saturated steam.
      b. 600 psi WOG.
   4. Provide with memory stop for balancing valves.
   5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
   6. All valves for domestic use must be lead free.

E. Valve Connections
   1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
   2. Thread pipe sizes 2 inches and smaller.

3. Flange pipe sizes 2-1/2 inches and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use press valves when using copper press systems.

F. Valve Operators
1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
2. When cocks and valves are furnished with square head stem:
   a. Provide one wrench for every ten cocks or valves sized 2 inches and smaller, minimum of two.
   b. Provide each cock or valve size 2-1/2 inches and larger with a wrench with setscrew.
3. Where butterfly valves are provided:
   a. Provide gear operators on valves 6 inches and larger.
   b. Where valves are located 7 feet or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5 feet above floor and hook to clips, arrange to clear walking space.
   c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4 inches and smaller.

G. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
2. Crane
3. Dezurik
4. Jenkins
5. Keystone
6. Kitz
7. Milwaukee Valve
8. Nibco
9. Stockham

H. Check Valves
1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
3. Acceptable Manufacturers (All listed must be lead free):
   a. Apollo
   b. Keystone
   c. Kitz
   d. Milwaukee
   e. Mission Duochek
   f. Nibco

I. Backflow Preventer (All valves for domestic use must be lead free):
1. BFP-1 (2 inches and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
2. BFP-2 (2-1/2 inches and larger) stainless steel or FDA epoxy coated ductile iron reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo

RP4ALF-YS or Watts 909-NRS-BB-S-LF.

J. Provide valves of same manufacturer throughout where possible.

K. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

L. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

M. Provide valve, seat and trim materials suitable for the intended service.

N. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. Bronze "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2 inch size and smaller with screw connections rated 400 psi WOG.
2. Over 2 inch size with flanged connections, rated 125 psi WOG.

C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2 inches.
2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
3. With 0.125 perforations in piping systems 4 inches and larger.

D. Start-up:
1. Provide an additional fine mesh disposable screen for use during start-up operations.
2. Remove after 30 days.
3. Attach to piping for Owner’s review.

E. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
2. Crane
3. Keckley
4. Kitz
5. Mueller
6. McAlear
7. Muesco
8. Nibco
9. Zurn

2.3 VALVE SCHEDULE

A. Domestic Service
1. Gas shut-off service: UL approved for natural gas service.
   a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL
   b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL
   c. Resun 2-1/2 inch and larger: 143 - 1-UL
   d. DeZurick 2-1/2 inch and larger: Series 425 or 435
   e. Locking Type: Rockford ¾ inch and 1 inch PNP-400
      Mueller 1-1/4 inch through 4 inch: Lub-O-seal
   f. Conbraco Ball Valve, full port through 4 inch: 64-100 Series
   h. Milwaukee Full Port ¼ inch-2 inch
   i. Milwaukee Standard Port 2-1/2 inch & 3 inch
   j. Kitz Full Port 2 inch =- #68
2. Cold and Hot water service (all listed must be Lead Free):

a. Nibco Ball Valve full port through 2 inch: T-585-66-LF
b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF
c. Nibco Butterfly Valve 4 inch and larger: LD-2000 EDPM Gaskets
d. Watts Ball Valve 4 inch and larger: G-4000-FDA
e. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
f. Kitz Full Port through 2 inch - #868M Lead Free
h. Milwaukee Full Port ¼ inch-2 inch
i. Milwaukee Standard Port 2-1/2 inch & 3 inch
j. Apollo Ball Valve Full Port through 2-1/2 inch 77CALF
k. Apollo Ball Valve Standard Port 3 inch 70LF
l. Apollo Butterfly Valve 4 inch and Larger LD141
m. Apollo Press Bronze Ball valves – 77 WLF

3. Check Valve (All listed must be Lead Free):
a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats)
b. Nibco Check Valve 2-1/2 inch and larger: F - 918 – Y -LF (Buna-N disc.)
c. Nibco Check Valve 2-1/2 inch and larger: W - 920 -W-LF (Wafer)
d. Kitz Y & Check: A-22T
e. Kitz 2-1/2 inch and Larger #778 C.I.
f. Kitz Wafer Check 2-1/2 inch and Larger #7032
g. Milwaukee Valve – 509T
h. Apollo Check Valve: 163TLF
i. Apollo Check Valve 2-1/2 inch and larger: 910FLF
j. Apollo Press Check Valve: 163TPR-LF
k. Apollo Check Valve 2 inch and larger 910WE-LF (Wafer)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.
B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.
D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
1. 1 inch valve for pipes 6 inch and larger.
2. 3/4 inch valve for pipes smaller than 6 inch.
3. Terminate with pipe plug.
4. Drain valves shall be ball valves.
F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
H. Provide clearance for installation of insulation and access to valves.
I. Provide access where valves are not exposed.

3.2 VALVE TAGS

A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment

being served and the service is obvious.

B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:

1. A specialist in this field and have the personnel, experience, training, skill, and the 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.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:

1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL
3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):

1. Pittsburg Corning
2. Cell-U-Foam

C. Aluminum Jacketing:
   1. Childers
   2. Pabco
   3. RPR

D. Fiberglass reinforcing cloth mesh:
   1. Perma Glass Mesh
   2. Alpha Glass Mesh
   3. Childers Chil-Glas
   4. Vimasco

E. Mastics and Adhesives
   1. Childers
   2. Foster
   3. Vimasco
   4. Armstrong 520 Adhesive

F. Elastomeric Insulation
   1. Armacell

G. Weather Resistant Coating
   1. WB Armaflex Finish

H. Glass fiber blanket insulation
   1. Manville R-series Microlite FSKL
   2. Owens-Corning eD75 or ED100 RKF
   3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
   1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.
   1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.4 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb./cu.ft. (128 kg/cu.m.) density

2.5 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
2. Minimum thickness of foam glass insulation shall not be less than 1” thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22”. Provide 18 gauge through 4” pipe and 16-gauge 5” pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 adhesive.
B. Vapor Barrier Finish:
1. Indoors: Provide as insulation coating Childers CP-35, white.
2. Outdoors: Provide as insulation coating Childers Encacel X.
3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
C. Sealant. Provide Childers CP-76 vapor barrier sealant.
D. Lagging Adhesive. Provide Childers CP-50.
E. Other products of equal quality will be acceptable only upon approval.

2.7 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016” thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.
B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024” thick.
C. Straps and Seals. Provide ½” x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.8 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
B. Install hanger with protective shield, on the outside of all insulation.
C. Where domestic water pipes (1/2” & ¾” pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4” pipe and 16-gauge for 5” pipe and above.
E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
G. Piping to be insulated as specified above:
1. All hot and cold water.
2. Make-up water

3. Horizontal sanitary drain piping that receives condensate
4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down

3.2 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
D. Apply a tack coat of fitting mastic over the insulation and tape.
E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
   1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
   2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
   3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
   4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
   5. Apply mastic to a wet film thickness of 3/64".
   6. Fabric shall not be visible after completion.
   7. Vapor seal flanges, valves and fittings with Childers CP-35.
B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.
B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.
C. Install straps on 9" centers and at each circumferential lap joint.
D. Cover and seal all exposed surfaces.
E. The use of screws and rivets is not approved.
F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using

a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.

D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

A. Install materials after piping has been tested and approved.

B. Apply insulation on clean, dry surfaces only.

C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION

SECTION 22 1116
DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Valves, Strainers and Vents
   2. Pipe and Pipe Fittings - General
   3. Plumbing Piping Insulation
   4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Below Slab on Grade Piping for Water Entries:
   1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
   2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a “bending” temper tubing.
   3. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.

B. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.

C. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.

D. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.

2.2 WATER HAMMER ARRESTORS

A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor’s Standard PDI WH-201; refer to schedule on drawings.

B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.

C. All water hammer arrestors shall be installed in a vertical position.

D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.1 DRAINAGE

A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be

maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

A. Sterilize the water system with solution containing not less than 50PPM available chlorine. Allow chlorinating solution to remain in system for period of 8 hours (minimum). Have valves and faucets opened and closed several times during the period. After sterilization, flush the solution from the system with clean water until residual chlorine content is less than 0.2 parts per million.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.4 TESTING

A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
C. Use only potable water for the test.
D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

A. Corrosion protect copper tube piping systems:
    1. In the building slab.
    2. Beneath the building slab.
    3. Buried.
    4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.
B. Cover copper tubing piping system with:
    1. "Tapecoat" TC Primer.
    2. "Tapecoat" CT cold applied coating tape.
C. Install coating system as specified by the manufacturer.
D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
B. Make repairs to small holes in accordance with the manufacturer's instructions.
C. Retest the repairs using procedures listed above.
D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION

SECTION 22 1123
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.

B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.

C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.

D. The pump curve shall rise continuously from maximum flow to cut-off.

E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.

F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.

G. Select the pump for operation at or near peak efficiency.

H. Cavitation-free at all points on the curve.

I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

B. Submit copies of manufacturer’s performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (Variable Speed) FRACTIONAL HORSEPOWER

A. Pump Construction:

1. Variable speed with automated ability to adjust and maintain optimum operating conditions Stainless steel housing
2. Check Valve
3. Flange or union connections
4. Built in timer

5. Built in temperature sensor
6. Build in differential pressure sensor
7. Programmable

B. Acceptable manufacturers:
1. Grundfos
2. Armstrong
3. Wilo

2.2 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

A. Pump Construction:
1. Hermetically sealed motor
2. Positive action air operated diaphragm switch
a. High water alarm contact
3. Housing and base cast iron construction

B. Provide an alarm terminal cabinet.
1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm”.

C. Test the sump pump package by operation of the completed system through four cycles of operation.
1. Fill the sump to operational levels
2. Visually check level controls
3. Pump operation
4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
5. Verify alarms
6. Verify pump capacity

D. Sump pump package capacity shall be as scheduled.

E. Acceptable Manufacturers:
1. Hydromatic
2. Little Giant Pump Co.
3. Weil
4. Goulds
5. Grundfos
6. Crane (Barnes) Air Pumps
7. Ebara
8. Zoeller Pumps

2.3 FLOW INDICATOR

A. Flow Indicator
1. Bronze Construction
2. Rotating wheel
3. Line Size
4. Double Window
5. Ernst Flow Industries Model EFI E-57-3

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
1. Provide access space around pumps for service.
2. Lubricate pumps prior to start-up.
3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60” above finished floor. Install line size Ernst bronze rotating wheel, flow indicator

with double window, downstream of circulator.

B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.

C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

D. Ensure pumps:
   1. Operate at specified system fluid temperatures without vapor binding and cavitation.
   2. Are non-overloading in parallel and individual operation.
   3. Operate within 25 percent of midpoint of published maximum efficiency curve.

E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.

B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.

C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
   1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).

B. Before starting pumps, but after connecting piping:
   1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
   2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
   3. Submit readings for approval.
   4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
   1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
   2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.

B. Enter the information on the final configuration of the pump in the Owner's Manual.
   1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

A. Provide the following spare parts and material to the Owner for his use after the warranty period.
   1. A mechanical seal for each pump
   2. A set of bearings for each pump

END OF SECTION

SECTION 22 1313
FACILITY SANITARY SEWERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Section includes gravity-flow, outside the building, with the following components:
   1. Cleanouts
   2. Manholes

B. All public work to be performed and materials to be used within the street right-of-way, shall be in accordance with the City of Austin Design Standards.

C. All private work to be performed and materials to be used beyond the street right-of-way shall be in accordance with the Plumbing Code. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the plans, the City Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.02 DEFINITIONS

D. PVC: Polyvinyl chloride plastic.

1.03 PERFORMANCE REQUIRMENTS

E. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-food head of water (30 kPa).

1.04 SUBMITTALS

F. Product Data: For the following:
   1. Special pipe fittings.

G. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers.

H. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

I. Field Quality-control test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

J. Do not store plastic manholes, pipe, and fittings in direct sunlight.

K. Protect pipe, pipe fittings, and seals from dirt and damage.

L. Handle manholes according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

M. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints and using ASTM F 477, elastomeric seals.

1. Fittings NPS 4 to NPS 8 (DN 100 to DN 200): PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
2. Fittings NPS 10 (DN 250) and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

B. PVC Sewer Pipe and Fittings, NPS 16 and Smaller: ASTM D 3034, SDR 26, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.02 NONPRESSURE-TYPE PIPE COUPLINGS

C. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Sleeve Materials:
1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.03 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast, reinforces concrete, of depth indicated, with provision for rubber gasketed joints, and pipe boots.
1. Inside diameter: 48 inches minimum, unless otherwise indicated.
2. Base section: 8 inches minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
3. Riser sections: 5-inch minimum thickness.
4. Top Section: Eccentric-cone type, unless otherwise indicated.
5. Gaskets: ASTM C 443, rubber (when required by local authority having jurisdiction).
6. Pipe connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
7. Joints of the manhole sections shall be of the tongue and groove type, filled with an approved preformed butyl rubber base, sealing compound, conforming to Federal Specifications SS-S210A, Type 1, Rope form.
8. Inside of the manhole shall have a Thane Coat installed for all sanitary manholes located inside of the property boundary.

B. Standard manhole frames and covers shall conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable). Otherwise, manhole frames and covers to be Neenah Foundary Co. No. R-1642 or Vulcan Foundary Inc. No. V-1357, 30” opening.

C. All sanitary sewer manhole covers shall have the word “SANITARY SEWER” cast on the top in letters 2 inches higher.

2.04 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug, with a 2’ x 2’ x 6” thick concrete apron.
1. Available Manufacturers:

a. Refer to City of Austin Utility Standards, latest edition.
2. Top-Loading Classification: Extra-heavy duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.05 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section “Earth Moving.”

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping:
1. NPS 3 (DN 80): NPS 4 (DN 100) PVC sewer pipe and fittings, gaskets, and gasketed joints.
2. NPS 4 (DN 100): PVC sewer pipe and fittings, gaskets, and gasketed joints.
3. NPS 5 and NPS 6 (DN 125 and DN 150): NPS 6 (DN 150) PVC sewer pipe and fittings, gaskets, and gasketed joints.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch (915-mm) minimum cover.
4. Install piping below frost line.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

3.04 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing" Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
2. Join dissimilar pipe materials with nonpressure-type, flexible [or rigid] couplings.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 923.

C. Construct cast-in-place manholes as indicated.

D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.

E. Install FRP manholes according to manufacturer's written instructions.

F. Form continuous concrete channels and benches between inlets and outlet.

G. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm)] above finished surface elsewhere, unless otherwise indicated.

H. Install manhole cover inserts in frame and immediately below cover.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

2. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 24” by 24” by 6” deep. Set with tops 1 inch (25 mm) above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi (20.7 MPa), unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to grease interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.09 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter. Hand pulled no earlier than 30 days after backfill was completed.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
   a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
   b. Close openings in system and fill with water.
   c. Purge air and refill with water.
   d. Disconnect water supply.
   e. Test and inspect joints for leaks.
   f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig (69 kPa).
6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
   b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).
7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

SECTION 22 1316
SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

A. Site Work:
   1. Sanitary Sewers
   2. Excavation, Trenching and Backfilling for Utilities
B. Division 22 Plumbing:
   1. Pipe and Pipe Fittings
   2. Plumbing Fixtures and Fixture Carriers
   3. Drains, Cleanouts and Hydrants
   4. Earthwork

1.3 REFERENCES

A. CISPI - Cast Iron Soil Pipe Institute
B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All No-Hub clamps must have 4 bands minimum. Sizes 5” through 10” shall have six bands minimum.
   1. No-Hub Clamps – Sanitary Waste:
      a. Husky SD 4000
   2. No-Hub Clamps - Vents
      a. Husky SD – 2000
      b. Mission Rubber Co., LLC Heavy Weight Couplings
   3. Clamp-All Hi-TorQ 80 or approved equal
B. Provide Husky shielded couplings Series 4200 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2” through 8” Series 4200.
C. Cast Iron Soil Pipe and Fittings:
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

A. Above Slab Pipe:
   1. Service weight cast iron hub and spigot pipe and fittings.
   2. Compression type, with neoprene gaskets shall conform to ASTM C-564.
   3. Pipe shall conform to requirements of ASTM A74.
   4. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute
B. Below Slab on Grade Piping:
   1. Schedule 40 PVC plastic pipe and DWV fittings.
   2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
   3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.
C. Below Slab on Grade Piping for Grease Waste as indicated on Drawings for Hot Grease Waste Discharge:

1. Hub and spigot cast iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International. The inside of each pipe shall be reamed prior to coating to decrease the coefficient of friction. The pipe coating shall consist of chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high performance cathodic epoxy coating, and finally an electrically deposited, high performance anodic epoxy top coat. The fittings coating shall consist of a chemically deposited zinc-phosphate pretreatment layer followed by and electrically deposited, high performance cathodic epoxy coating and finally an epoxy acrylic powder top coat as manufactured by Charlotte or Tyler.

2.3 VENT PIPE AND FITTINGS

A. Above Slab Pipe:
   1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
   2. Pipe shall conform to ASTM A74.
   3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
   4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564

B. Below Slab on Grade Piping:
   1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.

C. Above Slab Pipe.
   1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer’s recommendations and applicable standards.

D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.

E. All PVC underground shall be installed in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal pipe grade of ¼-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.3 DRAIN PIPE AND FITTINGS

A. Offsets and Fittings.
   1. Use reduction fittings to connect two pipes of different diameter.
   2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eights-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
   3. Provide a separate trap at each fixture, unless a trap is built into the fixture.

Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.

4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.

B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.

C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.

1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.

D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.4 VENT PIPING

A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.

B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.

C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

3.5 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:

1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.

7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.6 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All sanitary soil and waste lines below building 3” and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner’s Representative shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner’s Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.7 SMOKE TESTING

A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing on all interior sanitary sewer piping and sanitary vent piping above and below floor prior to cover-up..
2. Artificially created smoke used must be a persistent white tracer smoke and produced by thermogenic chemical reaction. All smoke candles or smoke pencils to be used must be non-toxic and EPA approved. Provided by Superior Signal Smoke Candles.
3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
6. Typical findings from indoor smoke testing may include:
   a. Dry traps in floor drains
   b. Improperly capped sewer lines or vents

c. Broken sewer lines or vents
d. Cross connected sewer vents and drains
e. The drawing of air emanating from sewer vents into intakes of air exchange systems
f. Poorly glued pipe joints
g. Loose no-hub couplings

7. An Owner's Representative shall be present during smoke testing.

END OF SECTION

SECTION 22 1413
ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Pipe and Pipe Fittings - General; for general piping requirements.
   2. Drains and Cleanouts.
   3. Plumbing Piping Insulation.
   4. Earthwork

1.3 REFERENCES

A. CISPI – Cast Iron Soil Pipe Institute
B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

A. Cast Iron Soil Pipe and Fittings
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.1 STORM PIPE AND FITTINGS

A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
C. Provide Husky shielded couplings, Series 4200 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2” through 8” use Series 4200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

3.2 GRADE

A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:
   1. Test pipe below slab on grade before backfilling and connecting to city sewers.

2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.4 RODDING SEWERS

A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All storm lines below building 3” and larger shall be internally video-taped at time of substantial completion. An Owner’s Representative shall be present during video-taping. Three copies of the video-tape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner’s Representative, as part of the Contract, to ensure 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 for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION

SECTION 22 2000
PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Earthwork
   2. Valves, Strainers and Vents
   3. Insulation
   4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. 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.

C. Solder joints.
   1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
   1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
   2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
   3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
   4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
   5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
2. 6" through 10" pipe size coupling housing minimum of 4" width.
3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.

G. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.

H. Ring-Tite Joints: Ring-Tite gasketed sewer fittings for sanitary and storm. Furnish joints for installation manufactured per ASTM/CSA, Ipex, and J.M Eagle C900. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 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.

2.5 GASKETS

A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. 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.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
D. Install piping without tapping out of the bottom of pipe.
E. Press Connections: Copper and steel press fittings ½” through 4” shall be applied in accordance with the manufacturer’s installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-“Pro-Press”.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
B. Provide supports both sides of elbows for pipe 6" and larger.
C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
E. Install trapeze hangers, properly sized, to support the intended load without distortion.
F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
H. Support spacing: As recommended by the project structural engineer and support

manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface.

Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. 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.

B. 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 strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances 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.

D. 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.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. 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. Flush system and replace with clean water.

G. Phase Three: Final flushing and rinsing: 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.

H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times

operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
   1. Both sides of penetrations through walls, floors and ceilings.
   2. Close to valves or flanges.
   3. Intervals on straight pipe runs not to exceed 50 feet
   4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 22 3333
ELECTRIC WATER HEATER (Commercial ASME)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Domestic Water Piping.
   2. Plumbing Piping Insulation.
   3. Division 26 Electrical.

1.3 WARRANTY

A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lochinvar.
B. Bradford White
C. Rheem / Ruud
D. A. O. Smith

2.2 PRODUCTS

A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
C. Furnish factory-assembled, integral units equipped as follows:
   1. Immersion thermostat.
   2. High temperature limit switch (energy cutout).
   3. Low-water cutoff.
   4. Heavy duty UL rated for 100,000 cycles.
   5. Temperature and pressure relief valve.
   6. Anode rod.
D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.
E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
B. All installations shall be in accordance with the manufacturer's published recommendations.
C. Furnish all supports required by the equipment included in this Contract.
D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.
E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
   1. Install a line size shutoff valve in cold water inlet and hot water outlet close to

each heater.

2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.

F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

G. Route condensate to a vented receiver.

H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.

I. Set the operating and safety controls.

J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.

K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.

L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Drains, Hydrants and Cleanouts.
   2. Domestic Water Piping.
   3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Plumbing Fixtures (Vitreous China):
   1. American Standard.
   2. Kohler.
   3. Eljer

B. Plumbing Faucets:
   1. Chicago.

C. Supports and Carriers:
   1. Wade
   2. Zurn
   3. J.R. Smith.
   4. Josam.
   5. Watts
   6. MIFAB

D. Flush Valves:
   1. Sloan
   2. Zurn

E. Supplies, Stops and Chrome Plated Tubular Brass:
   1. McGuire
   2. Zurn

F. Water Closet Seats (Black only):
   1. Beneke
   2. Church
   3. Olsonite
   4. Bemis
   5. Centoco

G. Electric Drinking Fountains:
   1. Halsey Taylor
   2. Elkay

H. Floor Drains:
   1. Wade
   2. J.R. Smith
   3. Josam
   4. Zurn

5. Watts
6. MIFAB

I. Cleanouts:
1. Wade
2. J.R. Smith
3. Josam
4. Zurn
5. Watts
6. MIFAB

J. Shower Valves
1. Chicago
2. Acorn
3. Symmons
4. Bradley

K. Stainless Steel Sinks:
1. Elkay
2. Just
3. Franke

L. Mop Sinks:
1. Crane Fiat
2. Stern Williams

M. Roof Drains:
1. Wade
2. J.R. Smith
3. Josam
4. Zurn
5. Watts
6. MIFAB

N. Thermostatic Mixing Valves
1. Lawler
2. Symmons
3. Leonard
4. Powers
5. Holby
6. Bradley

O. Emergency Safety Equipment
1. Speakman
2. Bradley
3. Encon
4. Guardian
5. Haws

P. Shock Arrestors:
1. Precision Products
2. Sioux Chief

Q. Backflow Preventors
1. Watts
2. Febco
3. Wilkins
4. Beeco

R. Hose Bibbs
1. MIFAB

S. Wall Hydrants
1. MIFAB

T. Solids Interceptors
1. Wade

2. J.R. Smith
3. Zurn
4. Josam
5. MIFAB

2.2 REQUIREMENTS

A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions.
B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
H. All floor drains and floor sinks shall have Pro-Set “Trap Guard” for trap seal protection.
I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.
J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal resistant screws.
K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION

SECTION 22 6311
GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.

B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.

C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Plumbing Pipe and Fittings
   2. Valves and Vents

1.3 UTILITY CONNECTIONS

A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

A. Pipe 2 inch and Smaller:
   1. Schedule 40 ASTM A 53 black steel pipe
   2. Factory fabricated socket weld fittings.

B. Pipe Larger than 2 inch:
   1. Schedule 40 ASTM A 53 black steel pipe.
   2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).

C. Unions:
   1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
   2. Ground joint unions, with bronze seat.
   3. Flange joints for pipe larger than 2 inch in diameter.

D. Flanges:
   1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.

B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.

C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 VALVES

A. See Section 22 05 23.

2.4 GAS PRESSURE REGULATOR

A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down

position.

B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.

B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.

C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.

D. Sleeves.

1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.

E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.

F. Weld all gas piping above grade.

G. Provide test ports and isolation valves to enable proper testing of system in the future.

H. Provide isolation valve and unions across regulators for proper removal.

I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.

J. Gas Pressure Regulators / Vents:

1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with various installed devices can cause regulator malfunction.
2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
7. Ensure the end of the vent line is away from ANY potential ignition

sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment

8. Adhere to all applicable codes and regulations.

3.2 TESTING GAS PIPING

A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.
B. Test joints with a soap solution while lines are under pressure.
C. Repair leaks.
D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.
F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
   1. To find form online, go to: Texas School Gas Test Form
G. School renovations projects shall have all gas piping tested. Report and document gas leaks found to the Architect and Engineer. Repair leaks at no additional cost to the Owner.

3.3 IDENTIFICATION CONDUCTOR

A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
   1. Bolted gasketed cover with stainless steel screws.
   2. Screw type terminal strip.
   3. Legend on cover "gas pipe identification conductor."
C. Set in concrete pad.

3.4 PAINT EXPOSED OUTSIDE GAS PIPE

A. Interior and Exterior Gas piping shall be protected from rust.
B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

SECTION 23 0100
HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:

1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Schedule of filters for each item of equipment.
11. Schedule of belts for each item of equipment.
12. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:

a. Size: 8-1/2" x 11".
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 flyleaf 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. Schedule of filters for each air handling system.
k. Schedule of belts for each item of equipment.
l. Each Contractor's coordination drawings.
m. As installed color coded piping diagrams.
n. Charts of valve tag number, with location and function of each valve.
o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
p. 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 extended compressor warranty certificates.

END OF SECTION

SECTION 23 0400
ARCHITECTURAL REQUIREMENTS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Size, Weight, Fall Protection and Screening Requirements for HVAC Unit Field Modifications

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

C. Division 23 - Heating, Ventilating and Air Conditioning

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of all HVAC equipment with size, weight, fall protection and screening requirements for HVAC Units.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Provide engineered drawings stating compliance with this specification section.

C. Provide sightline study to verify compliance with this specification section.

1.05 QUALITY ASSURANCE

A. Work covered by this section of the specifications shall conform to the contract documents, as well as state and local codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Texas.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.06 ARCHITECTURAL REQUIREMENTS

A. The purpose of these specifications is to define the performance and design standards for modifications of HVAC equipment required for products not listed as "Basis of Design" or relocated due to other coordination parameters.

B. Coordinate the installation of all HVAC equipment with size, weight, fall protection and screening requirements for HVAC Units and make adustments as required to comply with state and local codes and ordinances.

C. Screening:
   1. Contractor shall verify that the unit heights and placement for the provided equipment and curbs do not exceed those detailed in the construction documents.

2. If the total height and placement differs from the locations or details of the construction documents, the Contractor shall perform a sightline study to verify compliance with the local screening codes and ordinances and make the required modifications to comply. Contractor shall verify compliance before any parapet walls are constructed or screening equipment is ordered.

D. Size:
1. Contractor shall verify the size of all units, roof curbs and structural openings for equipment that deviate from the units or openings as detailed in the construction documents and make the required adjustments.

E. Weight:
1. Contractor shall confirm the weights of the provided equipment and verify compliance with the designed loads shown on the construction documents. If the weights exceed those designed, Contractor shall coordinate with the General Contractor and Structural Detailer to adjust the joist or steel design as required.

F. Fall Protection:
1. Contractor shall provide fall protection for any unit locations that are modified in the field, where the modifications locate them adjacent to any hazzards that require fall protection by state or local codes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 23 0500
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.

B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Mechanical work shall comply with applicable inspection services:

1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A 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 has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with

dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (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 reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 / Revit CAD files on disk (CD Rom).

C. 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 RECORD 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 mechanical piping and elevation.
   7. Indicate exact location of all underground electrical raceways and elevations.
   8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
   10. Exact location of all electrical equipment in and outside of the building.
   11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or

omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.

B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.

C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:

1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 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 40 hours dedicated instructor time.
2. 8 hours on each of 5 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, and 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 Operating and Maintenance Manual.

3.6 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.7 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.9 INDOOR AIR QUALITY

A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.

B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.

C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.

D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.

E. Utilize manufacturer’s recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.

F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.

G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.

H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 0510
HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.
B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
    1. Field conditions.
    2. Condition of installation.
    3. Quality of workmanship.
    4. Start-up of equipment.
    5. Testing, adjusting, and balancing of equipment.
B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 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.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
    1. Rough-in.

2. Finish with all appurtenances in place.
3. Insulation installed.
4. Demonstrations.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 FAN/COIL UNITS

A. Mock-up a fan/coil unit completely installed, including:
   1. Primary, secondary and auxiliary drain pans.
   2. Piping connections; including all piping appurtenances.
   3. Pipe insulation.
   4. Condensate drain piping.
   5. Electrical connections.
   6. Duct connection beyond first transition.
   7. Block valves, balancing valves, and control valves.
   8. Cabinet/internal vibration isolation.
   9. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
   1. Filter accessibility.
   2. Accessibility to drain and components for service.
   3. Controls sequence.

3.2 AIR HANDLING UNIT

A. Mock-up an air handling unit, completely installed, including:
   1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
   2. Pipe insulation.
   3. Condensate drain piping.
   4. Electrical connections.
   5. Ductwork beyond the first transition.
   6. Control valves and bypass.
   7. Cabinet/internal vibration isolation.
   8. Block valves and balancing valves.
   9. Duct insulation.
   10. Instrumentation.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
   1. Filter accessibility.
   2. Accessibility to drain and components for service.
   3. Controls sequence.

3.3 CONSTANT VOLUME TERMINAL BOX

A. Mock-up a Constant Volume Terminal Box completely installed, including:
   1. Piping connections, including all piping appurtenances.
   2. Pipe insulation.
   3. Electrical connections.
   4. Duct connection beyond first transition.
   5. Block valves, balancing valves, and control valves.
   6. Cabinet/internal vibration isolation.
   7. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:

1. Control Sequence.
2. Accessibility to components for service.

3.4 HOT AND CHILLED WATER CIRCULATING PUMPS

A. Mock-up one each system pump, completely installed including:
   1. Pump mounted on housekeeping pad.
   2. Auxiliary drain pan. (Chilled water only)
   3. Piping to a point beyond the complete valve and instrumentation assemblies.
   4. Strainers with blowdown.
   5. Flexible piping connection.
   6. Pipe supports.
   7. Pipe insulation.
   8. Pump painting.
   9. Electrical connections.

3.5 PROTECTION OF EQUIPMENT

A. 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 a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 23 0511
MECHANICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor’s responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify actual HVAC supply and return piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
G. Clean and repair existing materials and equipment that remain or are to be reused.
H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.
B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.
C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.
G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.
H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.
I. Remove concrete housekeeping pad where materials or equipment have been removed.
J. Remove all known utilities, which do not provide service to the buildings that remain.
K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. The Contractor shall modify, remove, and/or 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 the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's

representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items 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 relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork 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 disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.

H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

3.7 REFRIGERANT DISPOSAL

A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes.

END OF SECTION

SECTION 23 0512
SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by these specifications as outlined below.
B. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data
C. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.
B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
   1. Actual mechanical equipment and components to be furnished
   2. Service clearance
   3. Relationship to other equipment and components
   4. Roof drains and leader piping
   5. Fire protection piping and equipment
D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26
F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.
F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.
B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents
C. Coordinate submittals with requirements of the work and of the Contract Documents.
D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes
I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number

3. Contractor's name, address and contact number.
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
a. Contractor
b. Subcontractor
c. Supplier
d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a re-submittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 23 0513
ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:

1. Motors for mechanical equipment.
2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
8. Pipe heat tracing.
9. Cooling tower vibration switch/interlock/reset.
10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
12. Wiring of all related make up water and circulating water system chemical treatment devices.
    a. Low voltage electric contacting water meter
    b. Solenoid valve/blow-down assembly
13. Radiant heater timer switches and/or thermostats
14. Low Voltage thermostat wiring

C. Refer to Division 23 Controls Sections for related control system wiring.

D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.

E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.

F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for mechanical equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.
   9. WEG

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:

C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

2.2 EQUIPMENT FABRICATION

A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or

adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.

B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 23 0514
HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

A. Division 23 - Mechanical
   1. Insulation
   2. Chilled Water Pumps
   3. Cooling Towers
   4. Hydronic Boilers
   5. Equipment Drain Pans

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

A. Type “L” copper with drainage pattern fittings.
B. For Hydronic Boilers and Flue Pipe – Schedule 40 CPVC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the system to facilitate easy removal.
   1. Use threaded plugged tee at each change of direction to permit cleaning.
   2. Install a cleanout every 50 feet of straight run piping
   3. Maintain a positive slope on all piping
B. Install a water seal trap leg based on the fan pressure.
   1. Size the length of the trap leg 1 inch larger than the actual system pressure.
C. Install traps and cleanout as shown in the drawing details.
   1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION

SECTION 23 0517
HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames
B. 14-gauge steel panels
C. Continuous fully concealed hinges
D. Flush screwdriver cam lock & cylinder lock for Owner selection
E. Automatic closing and latching mechanism
F. Prime coat finish
G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors
B. 16-Gauge stainless steel
C. 20-Gauge insulated sandwich-type door panel.
D. Two inch thick with fire rated insulation
E. Continuous fully concealed hinge
F. Automatic closing and latching mechanism
G. Knurled knob and recessed key operation for Owner selection
H. Interior latch release slide for opening from inside
I. Prime coat finish
J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor
B. MIFAB
C. Acudor
D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
B. Installation shall be in accordance with the manufacturer’s printed instructions.
C. Minimum size required:
    1. 36” x 24” for Mechanical HVAC equipment related items
    2. 18” x 18” for electrical related items

END OF SECTION

SECTION 23 0518
VARIABLE FREQUENCY INVERTER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a variable frequency inverter for the following equipment items.
   1. Air Handling Units.
   2. Pumps.
   3. Fans.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Electrical Provisions of Mechanical Work.
   2. Air Handling Units
   3. Pumps
   4. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.

B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

A. Submit manufacturer's information and shop drawings as specified.
   1. Complete technical details.
   2. Dimensions and manufacturer's installation manual.
   3. Schematic diagrams of the circuitry and field connections.
   4. Manufacturer's start-up manual.

1.5 STANDARDS

A. UL.
B. CSA.
C. ISO 9001
D. NEC.
E. FCC.

1.6 WARRANTY

A. The manufacturer shall provide a full parts and labor warranty for a period of five (5) years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ABB

2.2 CABINET

A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1 enclosure in interior AHU mechanical rooms and in NEMA 12 enclosure with deadsides and removable hinged, gasketed doors with provisions for locking in all Plant locations. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

2.3 INTERFERENCE WITH OTHER SYSTEMS

A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993

with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.

B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
   1. Shall not interfere with computer and other electronic systems in the building.
   2. If not inherently protected, provide a suitable isolation transformer.
   3. The system shall not produce spikes on the incoming line.

C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

2.4 PROTECTIVE CIRCUITS

A. Provide the following protection:
   1. Input line fuses or molded case circuit breaker rated at 100 AIC.
   2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
   3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
   4. Current limiting DC buss fuse between input and output sections of inventor.
   5. Input overvoltage trip at 480 vac + 10% trip.
   6. Input undervoltage at 480 vac – 10% trip
   7. Instantaneous overcurrent protection of solid state inverter devices.
   8. Individual overcurrent protection of solid state inverter devices.
   9. Output overvoltage trip.
   10. Loss of input phase, phase reversals, or blown fuse.
   11. Thermal overload trip for overload protection of solid state devices.
   12. Ground fault protection on start-up.
   13. Output line to line short circuit protection.
   14. Phase to phase short circuit or severe overload conditions of output.
   15. Overload of motor.
   16. Frequency stall.
   17. DC buss high voltage.
   18. Control function error.
   19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
   20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
   21. Capable of restarting into a rotating motor without component damage.
   22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
   23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal power is restored. Capable of establishing speed control without shutdown or component failure.
   24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.

25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.
27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault. Diagnostics to provide the following information:
    a. Operating mode at trip (Accel, Decel, Constant speed).
    b. Output current at trip.
    c. Output voltage at trip.
    d. Additional faults that occurred simultaneously of immediately before displayed tripped.

    Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

2.5 OPERATOR DEVICES

A. The following operator devices shall be door or remote mounted:
1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
2. Power on indication light.
3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
    a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
    b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from “hand” to “auto” and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.
    c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.
5. Programmable lockout code to prevent unauthorized programming.
6. Critical frequency avoidance capability (up to 3 resonant points).

2.6 FIELD ADJUSTMENTS

A. The following shall be adjustable in the field:
1. Maximum Speed: 0 to 125% adjustable.
2. Minimum Speed: 0 to 100% adjustable.
3. Acceleration/deceleration rates: 0 to 3600 sec.
4. Instantaneous overcurrent trip: 50% to 2000%.
5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
6. Current limit circuit: 60 to 100%.
7. Carrier frequency: 6 to 16 KHZ.
8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.

9. Control signal Bias: 0 to 80 HZ.
10. Control signal gain: 0 to 80 HZ.
11. Calibration of remote speed signal: 0 to 80 HZ.

2.7 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
   1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
      a. "Inverter" Mode connects the motor to the output of the inverter.
      b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
      c. "Off" Mode disconnects motor from all input power.
   2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
   3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
   4. A thermal overload to provide protection of motor in the bypass mode.
   5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – “inverter” or “bypass”) in response to a signal from the thermal overload and/or external safety circuits.
   6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

2.8 SERIAL COMMUNICATIONS

A. The VFD shall have the capability of communicating with the EMS control system via an RS-485 serial port.

B. VFD shall be provided with protocol information specific to the selected EMS control manufacturer and shall be pre-configured at the factory to automatic communications, without the need for field programming.

C. Serial communications capabilities shall be included, but not limited to: run/stop control, speed set adjustment, proportional/integral or PID control adjustments, current limit and accel/decel time adjustments. The drive shall also have the capability of allowing the DDC system to monitor the following feedback signals: process variable, output speed/frequency, current, torque, power (KW), operating hours, kilowatt hours; relay outputs, and diagnostic warning and fault information.

D. The VFD shall allow the DDC system to control the drive’s digital and analog outputs and monitor all drive digital and analog inputs via the serial interface.

E. Provide BACnet interface card.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation as per manufacturer's recommendations and requirements.
   1. Inverter chassis is properly grounded.
   2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
   3. Both ends of conduit entering and leaving VFD into AHU cabinets and motors must be sealed air tight.

3.2 MANUFACTURER START-UP SERVICE

A. Factory trained personnel shall be provided for start-up assistance, minimum (1) day per

unit.

1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
3. Adjustable devices, components, and assemblies to assure optimum performance.
4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.

B. Input DC voltage to dry motor windings when fan is not in operation at the following locations:
   1. Cooling tower fan motor
   2. Motors downstream of coils
   3. Rooftop unit motors

3.3 DEMONSTRATION AND TRAINING

A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives.
B. Demonstrate operation of controllers in the automatic and manual modes.
C. Provide a minimum of two days of technical training for the owner's operating and technical staff. Schedule training with owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.
D. Training may be consecutive or random, at Owner's option.

END OF SECTION

SECTION 23 0519
HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

A. Division 23, Mechanical
   1. 23 05 00 - Mechanical General Provisions
   2. 23 20 00 - Pipe and Pipe Fittings, General
   3. 23 05 23 - Valves, Strainers and Vents
   4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

A. Trerice
B. Taylor
C. Marsh
D. Weksler
E. Marshalltown
F. Weiss
G. Miljoco

2.2 PRESSURE GAUGES

A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
B. Dial: White aluminum with black markings
C. Window: Clear acrylic
D. Tube: Phosphor bronze and forged brass socket.
E. Gauge accuracy: +/- 1% over operating range.
F. For pulsating service, provide impulse dampers.
G. Without flange for pipe mounting.
H. With flange for wall mounting.
I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
D. Wells shall be sized to extend a minimum of 50% into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

A. Die cast aluminum case with baked epoxy finish.
B. Adjustable angle 9" scale length.
C. Clear acrylic window.
D. Brass stem, length to match well.
E. Red reading organic spirit filled-in magnifying glass column.
F. White background with black figures and markings.
G. Brass stems and union connections.
H Accuracy: +/- 1% of scale range.
I. Range:
   1. Hot water lines: 30°F to 240°F.

2. Chilled water lines: 0°F to 100°F or 120°F
3. Condenser water: 0°F to 100°F.

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
   1. Fitted with a color coded cap strap with gasket.
   2. Acceptable Manufacturer: Peterson Equipment Company.
   3. Provide with extension neck to match insulation thickness.

B. Provide to the Owner a fitted case with:
   1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
   2. Four 5" stem pocket testing thermometers.
      a. Two with range 25°F to 125°F for chilled water and condenser water.
      b. Two with range 0°F to 220°F for hot water.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with drawing details and manufacturer's recommendations.

B. Provide a ball valve at each gauge.

C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.

D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.

E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.

F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
   1. Hot water lines: 30°F to 240°F.
   2. Chilled water lines: 0°F to 100°F or 120°F

END OF SECTION

SECTION 23 0523
HVAC VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC Valves
B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
   1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
   2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.

B. Butterfly Valves
   1. Butterfly valves shall conform to MSS-SP67.
   2. Liners, inserts and discs shall be suitable for the intended service.
   3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.

C. Balancing Valves
   1. Provide Circuit Setter type balancing valves with:
      a. Corrosion resistant plug with resilient seal.
      b. EPDM O-ring stem seal.
      c. Polyamide and TPE hand wheel with visual position indication.
      d. Removable hand wheel. Stem shall have integral locking mechanism / memory stop.
   2. Connections
      a. Through 2" pipe size use threaded connections.
      b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
   3. Provide each valve with:
      a. Locking feature/memory stop.
      b. Plastic drip caps on pressure ports.
      c. 1/8" gauge tap.

D. Ball Valves
   1. Provide ball valves with:
      a. Blowout proof stem.
      b. Full size port, 316 stainless steel ball and stem.
      c. Cast bronze body.
      d. Threaded ends.
   2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
   3. Service rating:
      a. 150 psi saturated steam.
      b. 600 psi WOG.
   4. Where piping is insulated, ball valves shall be equipped with 2” extended handles of non-thermal conductive material. Provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
   5. Provide with memory stop for balancing valves.

E. Valve Connections
   1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
   2. Thread pipe sizes 2" and smaller.
   3. Flange pipe sizes 2-1/2" and larger.

4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

F. Valve Operators
1. Where butterfly valves are provided:
a. Provide gear operators on valves 6" and larger.
b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
e. All valves 2-1/2” and larger provided by Milwaukee Valve shall be provided with gear operators.

G. Acceptable Manufacturers
1. Dezurik
2. Crane
3. Nibco
4. Keystone
5. Milwaukee Valve
6. Tour and Andersson (Circuit Setters)

H. Check Valves
1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
3. Acceptable Manufacturers
a. Mission Duochek
b. Nibco
c. Keystone
d. Milwaukee Valve

I. Provide valves of same manufacturer throughout where possible.

J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

L. Provide valve, seat and trim materials suitable for the intended service.

M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, caged or ball type.

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2" size and smaller with screw connections rated 400 psi WOG.
2. Over 2" size with flanged connections, rated 125 psi WOG.

C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2".
2. With 0.45 perforations in piping systems 2-1/2" and 3".
3. With 0.125 perforations in piping systems 4" and larger.

D. Start-up:
   1. Provide an additional fine mesh disposable screen for use during start-up operations.
   2. Remove after 30 days.
   3. Attach to piping for owners review.

E. Acceptable Manufacturers
   1. Crane
   2. Keckley
   3. Zurn
   4. Mueller
   5. McAlear
   6. Muesco

2.3 SUCTION DIFFUSER

A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.

B. Components:
   1. Inlet straightening vanes.
   2. Removable end cap.
   3. Gauge ports.
   4. Threaded strainer blow down port.
   5. Adjustable support foot.
   6. Removable magnetic insert.

C. The screen shall be as specified for pipe system strainers.

D. Provide an additional fine mesh disposable strainer for use during start up operations.
   1. Remove after 30 days operation and all flushing is complete.
   2. Attach to piping for owners review.

E. Construction:
   1. 2" size and smaller with screw connections rated 400 psi WOG.
   2. Over 2" size with flanged connections, rated 125 psi WOG.

F. Fabricate screens of Monel or type 304 stainless steel:
   1. With 20 mesh woven wire in piping systems through 2".
   2. With 0.045 perforations in piping systems 2-1/2" and 3".
   3. With 0.125 perforations in piping systems 4" and larger.

2.4 VALVE SCHEDULE

A. Hydronic Service
   1. Chilled Water Service
      a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
      b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
         Keystone Figure 222
      c. Circuit Setters Tour and Andersson series 786,787,788, and 789
   2. Heating & Condenser Water Service
      a. Ball Valves up to 2": Nibco T-585-70-66
      b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
         Keystone Figure 222
      c. Circuit Setters Tour and Andersson series 786,787,788, and 789
   3. Check Valve:
      a. Nibco Check Valve: T - 413 - B
      b. Nibco Check Valve 2-1/2" and larger: F - 918 - B
      c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)
      d. Keystone Check 2-1/2" and larger: FIQ 810

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.

C. Use butterfly valves and ball valves in circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.

D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
   1. 1" valve for pipes 6" and larger.
   2. 3/4" valve for pipes smaller than 6".
   3. Terminate with pipe plug.
   4. Drain valves shall be ball valves.

E. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.

F. Provide clearance for installation of insulation and access to valves.

G. Provide access where valves are not exposed.

H. Provide float valves / stilling wells in cooling tower or condenser water basins for water level control. Provide stilling wells around float valve to prevent turbulence ripples or wind interference.

3.3 PIPE SYSTEMS STRAINERS

A. Provide an additional fine mesh disposable strainer for use during start up operations.
   1. Remove after 30 days operation and all flushing is complete.
   2. Attach to piping for owners review.

B. Provide strainer in supply piping for all coil connections.

C. Provide strainer in condenser water piping entering chiller.

3.4 WATER SYSTEM AIR VENTS

A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.

B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION

SECTION 23 0533
HVAC PIPE HEAT TRACING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.

B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

A. Submit shop drawings and product data as specified in Section 23 05 12

B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.

C. Submit manufacturer's certified capacity charts with selections plotted thereon.

D. Submit manufacturer's installation instructions.

E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Raychem Corporation

B. Thermon Manufacturing Company

2.2 COMPONENTS

A. Self-regulating heater.

1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
6. Power connection, end seal, splice and tee kits components shall be applied in the field.
7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.

B. Install the pipe heat tracing cable under the pipe insulation.

C. Apply “Electrically Traced” signs to the outside of the thermal insulation.

D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
B. The specified wiring work includes:
   1. Wiring of control instruments between thermostat and junction boxes
   2. Installation of thermostat and junction boxes
   3. Wiring from the heat tracing cable to the junction boxes
C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
D. Provide devices and appurtenances as specified in Division 26.
E. Identify each circuit at each terminal with a separate tag.
F. Color code wires in accordance with IPCEA Standards.
G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

A. Test the pipe heat tracing system:
   1. Simulate freezing outside air conditions
   2. Measure the amperage draw of the heat tracing system
   3. Compare to the manufacturer's capacity rating of the actual system
   4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.
B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION

SECTION 23 0548
VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SCOPE

A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
   2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Amber Booth
B. Kinetics
C. Mason
D. Korfund
E. VSI.
F. Vibration Eliminator Co., Inc.
G. Metraflex

2.2 ISOLATOR TYPES

A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.

B. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or ¼ inch (6mm) neoprene acoustical friction pad between the base plate 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 a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

C. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B 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.

D. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating concrete bases. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 inches (150mm). The base depth need not exceed 12 inches (300mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2-inch (12mm) bars welded in place on 6 inch (150mm) centers running both ways in a layer 1-1/2 inch (40mm) above

the bottom. Forms shall be furnished with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1-inch (25mm) clearance below the base. Wooden formed bases leaving a concrete rather then a steel finish are not acceptable.

E. Flexible stainless steel hose and braid flexible connectors having stainless steel braid and carbon steel fittings. Sizes 2.5" and larger shall be flanged. Smaller sizes shall have threaded connections. All flex connectors must be inspected (prior to being insulated) by the local factory representative for proper installation, and certification of proper installation must be included in the final inspection report.

F. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3 inch (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.

G. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind forces. All directional neoprene snubber bushings shall be a minimum of 1/4 inch (6mm) thick. Steel springs shall be laterally stable and rest on 1/4 inch (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2 inches (50mm) of insulation.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Chiller	A	0.35”
Pump (Above Grade)	B & D	1.5”
In-Line Fans	C	0.5”
Suspended Fan Coil Units	C	0.5”
Condensing Units (Ground Mounted)	A	0.35”
Condensing Units (Roof Mounted)	A	0.35”
Roof Mounted Air Handling Units	G	2”

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	E
Suspended Pumps	E
Chiller Pipe Connections	E

EQUIPMENT	ISOLATOR TYPE
Chiller Refrigerant Relief	F

2.5 FLEXIBLE CONNECTIONS IN PIPING AT PUMPS

A. Provide flexible connections at suction and discharge of chilled water, and hot water pumps, piping connections on chillers and where indicated on drawings. Refer to schedule above.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.

B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 0593
TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Balance, adjust and test the air distribution system including the exhaust system.
B. Balance, adjust and test the hydronic system.
C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

A. History of the TAB organization.
B. Agency certification.
C. Personnel qualifications.
D. TAB data forms.
E. Instrumentation list.
F. Name of the project supervising engineer.
G. Name and address and contact person of five successfully completed projects of similar size and scope.
H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
E. The balancing agency shall have operated for a minimum of five years under its current name.
F. Personnel:
    1. The project supervisor shall be a Professional Engineer registered in Texas.
        a. Extensive knowledge of the work involved.
        b. At least five years experience conducting tests of the type specified.
        c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
    2. All work shall be conducted under the direct supervision of the supervising engineer.
    3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

A. Provide (AABC) guarantee in writing.
B. Extended warranty.
    1. Include an extended warranty of 2 years after completion of test and balance

work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.

2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.

B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.

C. Note proper piping installation, location of valves, and flow measuring instruments.

D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.

E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.3 TESTING INSTRUMENTS

A. Submit a list of all instruments to be used for the test and balance procedures.
   1. Catalog sheets
   2. Certificate of last calibration
   3. Calibration within a period of six months prior to balancing

B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.

B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.

C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall

provide all necessary software and special interface cables, as required, to communicate with the DDC system:

1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
2. Verify that all control devices are properly connected.
3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
7. Observe the calibration of all controllers.
8. Verify the proper application of all normally opened and normally closed valves.
9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
13. Check all dampers for free operation.
14. Verify that all controller setpoints meet the design intent.
15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.5 INSTRUMENT TEST HOLES

A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:

1. Drill holes, plug and tape external duct insulation.
2. Repair damaged insulation to Engineer’s approval.

3.6 TESTING THE AIR DISTRIBUTION SYSTEM

A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Supply Fans:
   a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
   b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
   c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply

and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.

d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.

e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.

2. All Other Fans:

a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.

b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.

d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.

3. VAV Terminal Units:

a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.

b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.

4. Diffusers, Registers and Grilles:

a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.

5. Coils (including electric coils):

a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.

B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.

C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.

D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.

E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.

F. Measure and adjust all supply and return branches to design air delivery.

G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.

H. Make a set of recordings showing final system conditions.

3.7 TESTING THE HYDRONIC SYSTEMS

A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
   1. Record preliminary pump data.
      a. Pump RPM.
      b. Pump shut-off differential head.
      c. Pump operating differential head.
      d. Check and verify pump alignment.
      e. Verify impeller diameter.

B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.

C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.

D. Balance flow through:
   1. Chillers.
   2. Coils.
   3. Boiler.
   4. Pumps
   5. Condensers.
   6. Cooling tower.
   7. Heat Exchanger.

E. Use flow meters, differential pressures and temperature relationships as required.

F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.

G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.

H. Pumps:
   1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation Record appropriate gauge readings for final TDH and Block-Off\Dead head calculations. Check and verify pump alignment.
   2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

I. Coils:
   1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
   2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.

J. Boilers:
   1. Verify that boilers have been filled and started by others, and are in operation.
   2. Current and Voltage: As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
   3. Test, adjust and record water flows through water boilers.
   4. Test and record water temperature profiles of each boiler.

K. Chillers:
   1. Verify that chillers have been started by the manufacture and are in operation.

Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.

2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
3. Test and record temperature profiles of each chiller at design water flow.

3.8 EQUIPMENT POWER READINGS

A. Record the following information for each motor:
   1. Equipment designation.
   2. Manufacturer.
   3. Unit model number and serial number and frame.
   4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
   5. Heater coil in starter.
      a. Rating in amperes.
      b. Manufacturer's recommendation.
   6. Motor RPM/driven equipment RPM.
   7. Power reading (voltage, amperes of all legs at motor terminals).

3.9 BOILERS

A. Check for proper operation and with operation at near design conditions, record the following:
   1. Manufacturer, model number, serial number and nameplate.
   2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
   3. Type of fuel and heating value.
   4. Rate of fuel consumption.
   5. Capacity in MBH.
   6. Efficiency.
   7. Flue gas analysis.
   8. Motor data.

B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

3.10 CHILLERS (Air Cooled)

A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.

B. Verification of safety interlocks and controls are the responsibility of the manufacturer.

C. With each chiller operating at near design temperature conditions, measure and record the following:
   1. Manufacturer, model number, serial number and all nameplate data.
   2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
   3. Condenser air entering temperature, leaving temperature.
   4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
   5. Volts and amps for each phase.
   6. Power factor.
   7. KW input.
   8. Tons of cooling.
   9. KW per ton of cooling.

D. Reference chiller specification for additional requirements.

3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM

A. All VAV boxes used are to be calibrated to produce the rated air quantity.
B. Set and record the supply air static pressure controller to provide actual design air flow at the most resistive terminal.
C. Measure and adjust the design air delivery at the inlet of each VAV box.
D. Measure and record the air quantity from each VAV box at its maximum flow. Manipulate the controller to achieve maximum flow.
E. Reset each box to yield and record minimum primary air flow.
   1. DDC controllers record the correction factor required to establish actual desired air quantity as designed.
   2. Pneumatic controllers adjust velocity controller as required to establish actual desired air quantity as designed.
F. If the box is operating with inlet static pressure in excess of the minimum cataloged pressure specified by the manufacturer and is not producing rated air quantity, field adjust the box to produce rated air quantity. Retest until approved results are obtained.
G. Position the VAV boxes to the proportion of maximum fan air volume to total installed box maximum volume.
H. Set the fan to deliver the AHUs scheduled design airflow.
I. Perform and record a total air traverse.
J. With the system terminal boxes set for full flow or diversity, the system will be delivering the scheduled design CFM with the most restrictive box in control. Make a speed increase if either or both static and volume are low.
K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent excessive static in the system.
L. Coordinate with the work specified in Building Management and Control System on the final location of the sensors for the static pressure controller. Locate in the supply duct far enough from the fan discharge to be truly representative of the average static pressure in the system.
M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static pressure sensing network.
N. Make a set of recordings showing final system conditions including system duct static pressures and control system setpoint.

3.12 DUCT TEST

A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.13 DIRECT EXPANSION EQUIPMENT

A. With each unit operating at near design conditions, measure and record the following:
   1. Manufacturer, model number, serial number and all nameplate data.
   2. Ambient temperature, condenser discharge temperature.
   3. Amperage and voltage for each phase.
   4. Leaving and entering air temperatures.
   5. Suction and discharge pressures and temperatures.
   6. Tons of cooling.
   7. Verification that moisture indicator shows dry refrigerant.

3.14 TAB REPORT

A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a

"Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.

B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.

C. Submit reports on forms approved by the engineer that will include the following data as a minimum:

1. Title Page
   a. Company Name
   b. Company Address
   c. Company telephone number
   d. Project name
   e. Project location
   f. Project Manager
   g. Project Engineer
   h. Project Contractor
   I. Project Identification Number
2. Summary of the TAB report data
3. Index
4. Instrument List
   a. Instrument
   b. Manufacturer
   c. Model
   d. Serial Number
   e. Range
   f. Calibration Date
   g. What test instrument is to be used for:
5. Fan Data
   a. Location
   b. Manufacturer
   c. Model
   d. Air flow, specified and actual
   e. Total static pressure (total external) specified and actual
   f. Inlet pressure
   g. Discharge pressure
   h. Fan RPM
6. Return Air/Outside Air Data
   a. Identification/location
   b. Design return air flow
   c. Actual return air flow
   d. Design outside air flow
   e. Actual outside air flow
   f. Return air temperature
   g. Outside air temperature
   h. Required mixed air temperature
   I. Actual mixed air temperature
7. Electric Motors
   a. Manufacturer
   b. HP/BHP
   c. Phase, voltage, amperage, nameplate, actual
   d. PM
   e. Service Factor
   f. Starter size, heater elements, rating
8. V-Belt Drive
   a. Identification/location

b. Required driven RPM
c. Drive sheave, diameter and RPM
d. Belt, size and quantity
e. Motor sheave, diameter and RPM
f. Center-to-center distance, maximum, minimum and actual

9. Duct Traverse
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   I. Air correction factor
10. Air Monitoring Station Data
   a. Identification/location
   b. System
   c. Size
   d. Area
   e. Design velocity
   f. Design air flow
   g. Test velocity
   h. Test air flow
11. Air Distribution Test Sheet
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Correction factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i. Test (final) air flow
12. Pump Data
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP
   g. Actual flow rate, pressure drop, BHP
   h. Discharge pressure
   I. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure
   m. Pressure differential settings
13. Cooling Coil Data
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Entering air DB temperature, design and actual
   f. Entering air WB temperature, design and actual

g. Leaving air DB temperature, design and actual
h. Leaving air WB temperature, design and actual
i. Water pressure flow, design and actual
j. Water pressure drop, design and actual
k. Entering water temperature, design and actual
l. Leaving water temperature, design and actual
m. Air pressure drop, design and actual
n. Capacity - sensible and latent

14. Heating Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual
    g. Water pressure flow, design and actual
    h. Water pressure drop, design and actual
    i. Entering water temperature, design and actual
    j. Leaving water temperature, design and actual
    k. Air pressure drop, design and actual
    l. Capacity
15. Electric Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual
    g. Electrical Characteristics
    h. Capacity
16. Sound Level Report
    a. Location (Location established by the design engineer)
    b. N C curve for eight (8) bands-equipment off
    c. N C curve for eight (8) bands-equipment on
17. Vibration Test on equipment having 10 HP motors or greater in size.
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (if applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)
    b. Test readings:
        1) Horizontal, velocity and displacement
        2) Vertical, velocity and displacement
        3) Axial, velocity and displacement
    c. Normally acceptable readings, velocity and acceleration
    d. Unusual conditions at time of test
    e. Vibration source (if non-complying)
18. Control verification indicating date performed and any abnormalities identified.
    a. Point Location/Description
    b. EMS Readout (Setpoint and Actual)

c. Actual Readout of all points
d. Interlocks
e. Safeties
f. Variable speed drive tracking with EMS input
g. Variable speed drive Bypass operation
h. Sequence of operation

END OF SECTION

SECTION 23 0594
COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Bring the work to a state of readiness for testing, balancing, and adjusting.
   1. Install air terminal devices.
   2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
   3. Verify lubrication of equipment.
   4. Install permanent instrumentation.
   5. Clean piping systems and fill with clean water.
   6. Complete "Start-up" of equipment.
   7. Check rotation and alignment of rotating equipment and tension of belted drives.
   8. Verify ratings of overload heaters in motor starters.
   9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
   10. Provide control diagrams and sequence of operation.
   11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
   12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
   13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
   14. Comb out fins on extended-surface heat transfer coils where damaged.
   15. Clean all strainers as required.
   16. Remove construction strainers after water is cleaned and treated.
   17. Remove all temporary filters from HVAC equipment.
   18. Provide start-up reports listing all start-up information and manufacturer’s information attached.
B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
C. Verify that the systems are ready for balancing and adjusting.
D. Submit a letter stating:
   1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
   2. Other equipment has been checked and started.
   3. The systems have been operated for the specified period of time.
   4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.
F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.
G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
B. Complete start-up of equipment prior to start of testing & balancing.
C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM

uipment scription	Actual			Disc. Switch Wired	Rotation Correct	Belt		RPM Correct Submittal	Vibration Isolation Correct	Attachment To Roof Curb	List Of Damage Parts	Bearings Lubricated	Filter Installed	Inte Da Ope
	Voltage	Amps	HP			Condition & Part #	Tension Correct							

END OF SECTION

SECTION 23 0713
EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install external insulation on supply, return, and outside air ductwork.

B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

A. Division 9 - FINISHES. Painting and Color Coding.

B. Division 23 - MECHANICAL.

1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
3. Insulation. Refer to specific sections on individual insulation types.
4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:

1. A specialist in this field and have the personnel, experience, training, skill, and the 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.

C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated system is not approved.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.

B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

A. Glass fiber rigid duct insulation.
   1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
   2. Acceptable Manufacturers
      a. Schuller 814 spin-glas FSK.
      b. Owens-Corning Type 703 board RKF.
      c. Knauf 3 PCF FSK.

B. Glass fiber blanket duct insulation.
   1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
   2. Acceptable Manufacturers
      a. Manville R-series Microlite FSKL.
      b. Owens-Corning ED100 RKF.
      c. Knauf 1.0 PCF FSK.

C. Fiberglass reinforcing cloth mesh.
   1. Acceptable Manufacturers
      a. Perma Glass Mesh.
      b. Alpha Glass Mesh.
      c. Childers Chil-Glas #10
      d. Foster Mast a Fab
      e. Vimasco.

D. Mastics, sealants, coatings and adhesives.
   1. Acceptable Manufacturers
      a. Childers.
      B. Foster.
      c. Vimasco.

E. Fireboard Insulation
   1. Totally encapsulated with foil facing.
   2. Two hour rated fire protection.
   3. Zero clearance to combustible protection.
   4. System shall be listed and labeled by an NRTL.
   5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
   6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
   7. Acceptable Manufacturers
      a. Unifrax ON Fyrewrap Elite 1.5
      b. Partak Insulation, Inc. Paroc Fireboard
      c. Thermal Ceramics FireMaster 3M
      d. Premier Refractories International, Pyroscat.

F. Rigid Closed Cell Insulation
   1. Acceptable Manufacturers
      a. Dow Trymer.
      b. Phenolic Foam.

G. Reinforced Foil Tape
   1. Acceptable Manufacturers
      a. Venture 1525CW

b. 3” FSK
2. Thickness 6.5 mils
3. Color: silver

2.2 COATING AND ADHESIVE

A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.
B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249.
C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

2.3 OUTDOOR DUCT LAMINATED JACKETING

A. Rubberized bitumen compound material:
1. Ultraviolet resistant
2. Weatherproof
3. Vapor retarding jacketing
4. Laminated jacketing
5. Cross-laminated high strength polyethylene film
6. Laminated to aluminum foil
7. Minimum 60-mil thickness
B. Acceptable Manufacturers:
1. Alumaguard 60
2. Flex Clad 400
3. Venture Clad 1577CW

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2” thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2”. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
D. On circumferential joint, the 2” flange on the facing shall be stapled with 9/16” outward clinch steel staples on 2” centers and taped using 3” wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.
E. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
1. Apply fabric and mastic to provide a smooth surface for painting.

B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.

D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.4 OUTDOOR DUCTWORK COVERING

A. Cover all supply and return ductwork outdoors:
   1. 1-1/2” thick, rigid closed cell insulation with reinforced foil facing.

B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.

C. Impale the insulation over mechanical fasteners and washers.
   1. A minimum of 2 rows of fasteners per side on 12-inch centers.
   2. Seal all breaks, joints and punctures by applying a 1/8” thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.

D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4”.

E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
   1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4”.
   2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8”.
   3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
   4. Aluminum gray or white finish as approved by the Architect.

F. Standing water on horizontal surfaces is not approved.

G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

A. Secure fireboard insulation to duct with impaling pins and 3” square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12” centers.

3.6 GENERAL INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Apply insulation on clean, dry surfaces only.

C. Continue insulation with vapor barrier through penetrations.

D. Neatly finish insulation at supports, protrusions and interruptions.

E. Install insulation on clean, dry surfaces, and only after building is weatherproofed

sufficiently to preclude any rainwater on insulation.

F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.

G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

SECTION 23 0716
VESSEL INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install insulation for both high and low temperature vessels.

B. Low temperature installations include expansion tanks, air eliminators, chiller nozzles, chiller heads and other vessels containing liquids 60°F and below.

C. High temperature installations include expansion tanks, air eliminators, domestic water storage tanks, boiler stack / transition and other vessels containing liquids above 60°F.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:

1. A specialist in this field and have the personnel, experience, training, skill, and the 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.

C. All vessel insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated vessel system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation, also repair any damage caused by the condensation.

F. Where existing insulated vessel, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

A. Division 9 Finishes. Painting and color-coding

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe & tank insulation:
   1. Schuller Type 817
   2. Owens-Corning Type 705
   3. Knauf 2.8 PCF
B. Closed cell, non-wicking pipe & tank insulation:
   1. Armaflex FS, 2” thickness
C. Aluminum Jacketing:
   1. Childers
   2. Pabco
   3. RPR
D. Monel Staples
   1. Bostich Monel
   2. Duo-Fast Monel
   3. Markwell Monel
E. Fiberglass reinforcing cloth mesh:
   1. Perma Glass Mesh
   2. Alpha Glass Mesh
   3. Childers Chil-Glas
   4. Foster Mast a Fab
F. Weather Resistant Coating:
   1. WB Armaflex Finish

2.2 CEMENT, MASTICS, SEALANTS, ADHESIVES AND COATINGS

A. Adhesive: Provide Childers CP-127 or Foster 85-60 fiberglass adhesive to seal insulation for low temperature vessels.
B. Adhesive / Joint Sealant: Provide Armaflex 520 adhesive to seal insulation for low and temperature vessels.
C. Lagging Adhesive / Coating: Furnish Childers CP50AHV2 or Foster 30-36 lagging adhesive / coating to provide a finish coat and to secure finish cloth for high temperature vessels.
D. Insulation Joint Sealant: Use Childers CP-76 or Foster 95-50 to seal the joints of insulation on low temperature vessels.
E. Metal Jacketing Sealant: Use Childers CP-76 or Foster 95-44 on all metal jacketing laps outdoors.
F. Vapor Barrier Coating: Indoors - Use Childers CP-38 or Foster 30-80 vapor barrier coating finish to coat the canvas finish on low temperature vessels. Permeance shall be 0.013 perms or less as tested by ASTM E96. Coating must comply with MIL-C-19565C, Type II and be QPL listed. Permeance shall be 0.03 perms or less at 30 mils, dry. Tested at 100°F and 90% RH per ASTM F 1249 and by Hypalon rubber based.
G. Weather Barrier Mastic: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic and reinforcing mesh for outdoor finish.
H. Reinforcing Mesh: Furnish 10 X 10 white glass or polyester reinforcing mesh.

PART 3 - EXECUTION

3.1 HIGH TEMPERATURE VESSELS (FIBERGLASS)

A. Apply a first layer of insulating board. Band the board on immediately after application, using bands on 12” centers, drawn tight and securely fastened.
B. Apply successive layers of insulation as specified for the first layer, with joints staggered. After insulation has been applied, finish with Childers CP-38 or Foster 30-80 vapor barrier coating reinforced with glass or polyester reinforcing mesh per manufacturer's recommendations. Provide a flood coat of Childers CP-10/11 or Foster 46-50 with Foster Mast a Fab polyester or Chil Glas #10 reinforcing mesh.
C. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily

removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with glass fiber wall cavity insulation.

3.2 LOW TEMPERATURE VESSELS (CLOSED CELL)

A. Apply a layer of insulating board. Band the insulation on immediately after application, using bands on 12” centers, drawn tight and securely fastened.

B. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with closed cell insulation.

C. Apply weather protective finish on closed cell insulation. Provide a minimum of three coats.

3.3 ALUMINUM JACKETING (Insulated vessels outdoors above grade)

A. Apply aluminum jacket on vessels according to manufacturer's recommendations using aluminum strapping and metal jacketing sealant to provide weather tight covering.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function.

C. Install straps on 12” centers.

3.4 VESSEL INSULATION REQUIREMENTS

A. Insulate all low and high temperature vessels located exterior (outside) of the building, including the following:
   1. Air separators
   2. Expansion Tanks
   3. Chemical feeders
   4. Chilled water system volume tanks
   5. Insulation thickness shall match thickness of adjoining pipe insulation

B. Insulate all low temperature vessels located interior (inside of the building, including the following:
   1. Air separators
   2. Chemical feeders
   3. Chilled water system volume tanks
   4. Insulation thickness shall match thickness of adjoining pipe insulation

C. Insulate the following high temperature vessels located interior (inside the building).
   1. Air Separators
   2. Insulation thickness shall match thickness of adjoining pipe insulation

D. As indicated on the drawings

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, hot water, refrigerant lines, condensate piping and make-up water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:

1. A specialist in this field and have the personnel, experience, training, skill, and the 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.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

A. Finishes. Painting and color-coding

B. Pipe Heat Tracing

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:

1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL

3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
2. Cell-U-Foam

C. Rigid Foam Insulation:
1. Kingsapan Tarec
2. Dow Trymer
3. Tarec Ecophen – Phenolic Foam

D. Aluminum Jacketing:
1. ITW Lock-on (Childers)
2. ITW Z-lock (Pabco)

E. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4 Foster Mast a Fab
5. Vimasco

F. Mastics, Sealants, Coatings and Adhesives
1. Childers
2. Foster
3. Vimasco
4. Armacell 520 Adhesive

G. Elastomeric Insulation
1. Armacell

H. Weather Resistant Coating
1. WB Armaflex Finish
2 Foster 30-64

I. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
2. Owens-Corning eD75 or ED100 RKF
3. Knauf 0.75 PCF FSK

2.2 RIGID FOAM PIPE INSULATION

A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

2.3 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.4 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming

particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.5 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.6 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
   1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
   2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.7 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.

B. Vapor Barrier Finish:
   1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.
   2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
   3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.

C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.

D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.

E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.

F. Other products of equal quality will be acceptable only upon approval.

2.8 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.

C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.9 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean,

facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.

B. Cover all chilled water piping with rigid foam insulation.
   1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
   2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½” wide glass filament tape.
   3. Apply a tack coat of fitting mastic over the insulation and tape.
   4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
   5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
   6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

C. Install hanger with protective shield, on the outside of all insulation.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4” pipe and 16-gauge for 5” pipe and above.

E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.

G. Piping to be insulated as specified above:
   1. Chilled water and heating water
   2. Make-up water

3.2 REFRIGERANT AND CONDENSATE PIPING

A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.

B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.

C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.

D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

3.3 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.
E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.
G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
H. Finish with aluminum jacketing as specified.

3.4 UNDERGROUND PIPE COVERING

A. Cover chilled and hot water piping underground with cellular glass insulation.
B. Butter insulation joints with Childers CP-76 or Foster 95-50 vapor barrier sealant. Secure with stainless steel bands or ½" fiberglass reinforced tape on 9" centers.
C. Cover valves and flanges with fabricated fittings of thickness and material equal to the adjoining insulation. Fasten fittings in place with stainless steel bands or ½" fiberglass reinforced tape.
D. Apply a tack coat of fitting mastic Childers CP-22/24 or Foster 60-25/26 over the insulation and bands.
E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
G. Seal ends of pipe insulation with vapor barrier mastic at all valves, fittings, flanges and every 21' on straight run piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe, making a complete seal.
H. Finish with 125 mil thickness Pittwrap jacket applied in accordance with manufacturer's instructions. At contractor's option, cover insulation with Servi-Wrap P-500 installed in accordance with manufacturer's instructions.

3.5 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
   1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
   2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
   3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2" on adjoining sections of pipe insulation.
   4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
   5. Apply coating/mastic to a wet film thickness of 3/64".
   6. Fabric shall not be visible after completion.
   7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.
B. PVC fitting covers are not acceptable.

3.6 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to

manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3” to make a weather tight seal with the application of 1/8” bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.

C. Install straps on 9” centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.7 MISCELLANEOUS

A. Insulate pumps.

B. Install materials after piping has been tested and approved.

C. Apply insulation on clean, dry surfaces only.

D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.8 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2” pipe)	1-1/2
Chilled Water Piping (2-1/2” pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2” Pipe and Larger	2
Heating Water Piping 1-1/2” Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5” Pipe and Larger	2
Exterior Chilled and Hot Water Piping 4” Pipe and Smaller	2

END OF SECTION

SECTION 23 0933A
BUILDING MANAGEMENT AND CONTROL SYSTEM (GENERAL)

PART 1 - GENERAL

1.1 SCOPE

A. This specification section addresses the existing control system modifications associated with the replacements and additions of equipment at the campuses which are not receiving complete Building Management and Control system replacement.

B. Scope of Work:

1. The existing facilities are controlled by an existing control system as outlined below. Miscellaneous equipment is being replaced and added as indicated on drawings. Provide and install all Building Management and Control System (BMCS) components required for the equipment being replaced and being added including industrial instrumentation necessary to obtain functions and results specified. The modifications and additions to the system includes items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
   a. **Creekwood Middle School -** Reliable Control system installed by Unify Energy Solutions.
   b. **Riverwood Middle School -** Reliable Control system installed by Unify Energy Solutions.

C. Temperature Control System components:

1. Electronic instruments as specified
2. Electric instruments as specified
3. Microcomputer instruments as specified

D. All control devices of the same type product shall be of a single manufacturer.

E. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.

1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.

F. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.

1. All components and elements
2. The testing and acceptance procedure

G. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

H. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.

1. All components and elements.
2. Start-up and point verification.
3. The testing and acceptance procedure.

1.2 RELATED WORK

A. Division 23, Mechanical
B. Division 26, Electrical

1.3 SUBMITTALS

A. Submit items of the Building Management and Control System (BMCS).

1. Temperature control equipment & Field devices.
2. Wiring & Flow diagrams.
3. Sequence of operation.
4. Complete, detailed, control and interlock-wiring diagram.
5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, “Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

B. Owner shall have final review and approval prior to start of work.

1.4 COOPERATION WITH OTHER TRADES

A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

A. Provide with a manufacturer’s parts and labor warranty for a period of two years from substantial completion. Warranty shall also include unlimited telephone technical support, sequence and graphical modifications. Through warranty period and at the end of warranty period firmware shall be updated to be the most current version available.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Reliable by Unify Energy Solutions

2.2 SYSTEM ARCHITECTURE

A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.

B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.

C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.

B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure of malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.

C. The failure of any DDCP on the network shall not affect the operation of other DDCP's.

All DDCP failure shall be annunciated at the specified alarm printers and terminals.

D. Network shall support a minimum communications speed of 115.2 Kbps.

E. The network shall support a minimum of 100 DDC controllers and PC workstations.

F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.

G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.

B. Each DDCP shall incorporate a real-time clock.

C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.

D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:

1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.

E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.

F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring
10. Seven (7) calendar days of operating schedules
11. Stand-alone operation

G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
3. **All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.**

H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
2. Operator interface
3. Network communications
4. Facilities and energy management functions

B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.

C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

A. The BMCS shall be provided with standard and custom report generation functions that include:
1. Alarm summaries
2. Motor status summaries
3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
4. Program listings

B. All reports shall be either displayed or printed by:
1. Operator request.
2. Time of day.
3. Event conditions (such as in response to an alarm, interlock, etc.).

C. All reports shall be time and date stamped.

D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.

E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.

F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.

G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.

H. Any invalid operator entry shall result in an error message.

I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.

J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.

1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.

B. The BMCS shall be provided with a global change and demand response feature.

1. Global modifications to schedules and setpoints shall be customizable and be accessed and modified from the district, building, zone, wing, pod and classroom level of system.
2. Global modifications shall download throughout the system as priority and shall be accomplish in an orderly and within 10 minutes.
3. System shall continue to download global modifications to the rest of the district even when one campus has lost communication because of a failed panel. System shall notify users of which panel has failed and has not accepted the global modification.
4. Demand response programming shall be integrated into the system to allow owner to facilitate strategies for shedding load in a timely manner.

C. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off

time. Appropriate time delays shall be provided to "stagger" on times.

1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
6. Schedules shall be quickly accessible by no more than two mouse clicks from all graphical pages. Schedules shall incorporate an area for users to add notes for description of event and author names.
7. System shall allow user defined common space group schedule creation and be fully customizable. For example, groups such as all kitchens, all gyms, all athletics, all hallways, etc.
8. System shall incorporate schedule modifications immediately and utilize the new schedule from time of creation.
9. System shall notify user of schedule not downloading and event not occurring as planned.
10. Schedules shall be fully accessible from mobile devices and use a scalable or responsive technology to provide full capabilities and functionality that is provided with the desktop software. Refer to Web Server requirements for mobile devices.
11. System shall include priority level schedules in a hierarchy configuration.
    a. Emergency Off highest priority (Freeze condition)
    b. Override 2nd highest priority (School dude schedules from Fs Direct)
    c. Holiday 3rd highest priority (Spring Break, Thanksgiving, Christmas)
    d. Normal 4th highest priority (Regular school hours)

D. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:

1. Enthalpy optimization.
2. Supply air reset.
3. Hot water reset.
4. Chilled water reset.
5. Volumetric control.
6. Static pressure reset.
7. Dead band control. Install dual set points as requested by user.
8. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

E. Software shall include an energy management analysis tool which will provide the users the ability to analyze, compare and normalize building energy consumption on a day, week, month and year time interval.

F. Software shall poll local airports and other facility BMCS systems for ambient temperature

and humidity valves. These values shall be compared to the readings at each campus and send an alarm to the system that a building temperature and humidity sensor has failed if the building values are 5 ˚F or 5% R.H. above or below (adjustable).

2.8 WEB SERVER ACCESSIBILITY

A. Industry leading encryption technology to provide accessibility through a web browser.

B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
   1. Alarm Display
   2. Point Commanding
   3. Graphic Display
   4. Scheduling
   5. Running Reports
   6. Point Details

2.9 REMOTE NOTIFICATION

A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
   1. Email
   2. Cell phones via text messages.
   3. Phones via voice message.

2.10 POINT EXPANSION MODULES

A. Capable of extending its input/output capabilities via special purpose modules.
   1. Modules may be mounted remote from the DDCP.
   2. Shall communicate with the DDCP over a pair of twisted cables.
   3. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
   4. All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.

2.11 TERMINAL EQUIPMENT CONTROLLERS

A. Provide for control of each piece of equipment, including, but not limited to, the following:
   1. Variable Air Volume (VAV) boxes
   2. Constant Air Volume (CAV) boxes
   3. Dual Duct Terminal Boxes
   4. Unit Conditioners
   5. Heat Pumps
   6. Unit Ventilators
   7. Room Pressurization
   8. Fan Coil Units

B. Include the following items:
   1. All input and outputs necessary to perform the specified control sequences.
      a. Analog outputs shall be industry standard signals such as 24V floating control.
   2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
   3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
   4. Return to full normal operation without user intervention after a power outage of unlimited duration.

5. Operation programs shall be field selectable for specific applications.
6. Specific control strategy requirements, allowing for additional system flexibility.
7. Controllers that require factory changes of all applications are not acceptable.
8. The failure of any terminal equipment controllers on the network shall not affect the operation of other terminal equipment controllers and be capable of standalone operation. All terminal equipment controller failures shall be annunciated at the specified alarm pages.

2.12 ELECTRONIC DAMPER ACTUATORS

A. Two position damper operators:
   1. Spring return to full travel position.
   2. Built in auxiliary switches (motor end switches)
      a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
   3. Minimum torque 60-in-lb

B. Modulating damper operators:
   1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
   2. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
   3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

A. Ethernet Card:
   1. Local area network connection interface card.

2.14 CONTROL CABINETS

A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
   1. Powder coat painted on all sides
   2. Cabinet with continuously piano type hinged door
   3. Locking latch
   4. All locks shall use a common key
   5. Devices on the panel face must be identified with engraved nameplates.
   6. Panels or termination panels must be identified with engraved nameplates.
   7. Provide enamel finish and extruded aluminum alloy frame UL 50 certified.
   8. Top of controls cabinet shall not be installed above 6’-0” AFF.

2.15 AUTOMATIC CONTROL VALVES

A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.

B. Construction:
   1. 2" and smaller:
      a. Screwed.
      b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
   2. 2-1/2" and larger:
      a. Flanged.
      b. Bodies: Cast iron or cast steel.
      c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
   3. Characterized port ball valves are acceptable for VAV terminal units only.

C. Modulating straight through water valves: Equal percentage contoured throttling plugs.

D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.

E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.

1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
2. Maximum pressure drop: 5.5 psi.
3. Relief and bypass valves: Sized according to pressure available.
4. 2-position valves: Line size.
5. Manual by-pass operator.

F. Electronic Actuator:
1. Direct coupled installation
2. Visual and electronic stroke indicator
3. Die-cast aluminum housing
4. Manual override
5. Self-lubricating bearing and gear train
6. Automatic calibration
7. Automatic duty cycle protection
8. Overload and stall protection
9. Non-spring return
10. Floating /0-10 VAC / 4-20mA operation
11. UL approved
12. Provide smooth modulating action and tight close off against the system pressure.
13. Torque to exceed the maximum required operating torque by not less than 150%.
14. Actuator input signal shall be compatible with output DDC controller.
15. Provide weatherproof enclosure (exterior use).
16. Damper actuators not acceptable for valves.

2.16 FLOW SWITCHES

A. Wetter parts made of type 316 stainless steel.
1. Designed for mounting in pipe tee.
2. Watertight, dust-tight, and corrosion resistant enclosure.
3. Paddle shall be factory fabricated to accommodate pipe sizes used.
4. Switching action shall be single pole double throw.

B. Approved manufacturer:
1. ITT McDonald Miller #FS7-4WL for piping over 8", FS7-4W for chilled water.
2. ITT McDonald Miller #FS7-4L for piping over 8", FS7-4 for hot and condenser water.

C. Remote Flow Solid-State Flow Detection:
1. Extended length flow probe
2. Cabinet-mounted control monitor
3. Wetted parts, 316 stainless steel probe
4. Optional temperature and wire-break outputs
5. Flow and temperature switch points
6. LED bar graph display for status indication

D. Approved Manufacturer:
1. IFM Effector

2.17 DIFFERENTIAL PRESSURE SWITCHES

A. Wet/wet differential pressure switch
1. Integral Mounting Frame
2. Watertight, dust-tight, and corrosion resistant enclosure.
3. Wetted materials of brass and flouroelastomer.
4. Externally adjustable set point

B. Approved manufacturer:
1. Square D #9012GGW4
2. Dwyer #DXW-11-153-1
3. Carrier #HK06ZC033

2.18 TEMPERATURE LOW LIMIT SWITCH

A. Responsive to the coldest 1' section of its length.
   1. Double pole single throw switch
   2. 20' capillary
   3. Line voltage with bellows actuated switch
   4. Auto reset for outdoor installation
   5. Manual reset for indoor installation

2.19 TEMPERATURE AND HUMIDITY SENSORS

A. Space Temperature Sensors
   1. Thermister with resistance of 10,000 ohms at 77°F.
   2. Accuracy shall be +/-1/2°F.
   3. Range of 55° to 95° F.
   4. Flush mounted
      a. Stainless steel flush mount sensor, submit sample for review.
   5. Location and height to be approved by Architect/Engineer prior to installation.
   6. Provide metal guards in the following locations:
      a. Corridors
      b. Cafeteria
      c. Kitchen
      d. Gymnasium
      e. Dressing Rooms
      f. Industrial Labs

B. Space / Duct Humidity Sensor
   1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
   2. Capacitance element shall be field replaceable and not require calibration.
   3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
   4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
   5. Provide manufacturers calibration certificate.
   6. Provide metal guards in the following locations:
      a. Corridors
      b. Cafeteria
      c. Kitchen.
      d. Gymnasium.
      e. Dressing Rooms.
      f. Industrial Labs.

C. Duct Temperature Sensors
   1. Range of 20° to 120°F.
   2. Single point sensing of temperature.
   3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
   4. Averaging elements of sufficient length to provide accurate, representative indication and control.
   5. Averaging elements of sufficient length to prevent variances in temperature or stratification.

D. Liquid Immersion Temperature Sensors
   1. Platinum type resistance temperature detector (RTD).
   2. Match sensor range to medium being monitored.
      a. Hot water range 30° to 250°F.
      b. Chilled Water 20° to 70°F.

3. Furnish stainless steel wells for installation by Mechanical Contractor.
4. Locate all sensors in field with Owner/Engineer present.
5. System accuracy for liquid temperature sensing shall be +/-1/2°.
6. Sensors must be removable from wells.

E. Outside Air / Freezer / Cooler Sensors
1. Range of –58° to 122°F.
2. Weatherproof sun shield.
3. External trim material corrosion resistant with all parts assembled into water tight, vibration-proof, heat resistant assembly.
4. Minimum of 8' long leads.
5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.

2.20 CURRENT SENSITIVE RELAYS

A. Ensure compatibility with VFD applications for variable speed motor status.
1. Provide with adjustable set point.
2. Relays must be mounted and not hung by power wires thru CT.
3. Provide split-core type current sensors.
4. Loop powered.
5. LED Status.
6. Acceptable Manufacturer: Veris Industries / Hawkeye
7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

2.21 DIFFERENTIAL PRESSURE TRANSDUCER

A. Transducers to convert differential pressures to 4-20 MA analog outputs.
1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
2. Factory calibrated and have zero and span trimmers for field calibration.
3. Range shall be selected to match the medium being monitored.
4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
5. LCD Display
6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.22 FLOW DIFFERENTIAL PRESSURE SWITCH

A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
1. Select the pressure range based on the sensed differential pressure.
2. The unit shall be protected against overpressure to the full static pressure rating.
3. Accuracy: +/- 2% of full scale.

B. Switch assembly.
1. Reed switch.
2. NEMA-4 enclosure.
3. Threaded boss conduit entrance.
4. SPST action.
5. Voltage and rating as required for the control circuit.

C. Wetted parts shall be made of type 303 stainless steel.

D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

2.23 ELECTRIC REMOTE BULB THERMOSTAT

A. Two position remote bulb thermostat:
1. Bimetal controlled.

2. Sealed mercury switches.
3. Provide specified control action.
4. Adjustment can be made by removing unit cover.
5. Element with capillary length as required for the location.

2.24 ELECTRIC SPACE THERMOSTAT

A. Two position space thermostat.
1. Single Pole switch actuated by bi-metal sensing element.
2. Range shall be 60°F to 90°F.
3. Removable external knob adjustment means.

2.25 HIGH STATIC PRESSURE SWITCH

A. With manual reset switch
1. Approved manufacturer: Cleveland AFS-460.

2.26 INSERTION FLOW SENSORS

A. Electromagnetic Flow Meter
1. Retractable hot tap flow sensor
2. Accuracy: +/- 1% of full scale
3. Custom thread-o-let 400 psi / 250°F rated
4. Installed into a 1” full port ball valve
5. Provided with an insertion depth gage
6. Line size from 2-1/2 to 72 inches
7. Metering range from 0.1 to 20 f/sec (200:1 turndown).
8. Remote NEMA 4 wall mounted LCD display
9. Field Pro Software & Communicator
10. Warranty two years
11. Approved Manufacturer: Onicon Electromagnetic Flow Meter F-3500 Series

2.27 CONTROL DAMPERS

A. Opposed blade dampers.
1. Frames of 13-gauge galvanized sheet metal.
2. Provisions for duct mounting.
3. Damper blades not exceeding 8" in width.
4. Blades of two sheets of 16-gauge galvanized sheet metal.
5. Blades suitable for high velocity performance.
6. Bearings of nylon or oil-impregnated, sinthered bronze.
7. Shafts of 1/2" zinc-plated steel
8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
10. Submit leakage and flow characteristics data with shop drawings.
11. Linkage shall be concealed out of the air stream within damper frame.
12. Acceptable Model is Ruskin Model CD60.

2.28 PHOTO CELL CONTROL

A. Light Sensitive Resistor.
1. 4-20 output or switch.
2. On = 3.0 / fc. Off 10.0 / fc.
3. UL Approved.

2.29 DRAIN PAN FLOAT SWITCH

A. Rated at 10 Amps.
1. Shuts off equipment if water level becomes too high.

2. DPDT Contacts.

2.30 BY-PASS AUTOMATIC SHUT-OFF TIMERS

A. Rated at 10 Amps, 125 VAC
1. Shuts off equipment with timed switch
2. White decorated timer
3. Without hold feature
4. Time Cycle 60 minutes

2.31 CO_2 SENSOR

A. Telaire Model T5100 CO_2/Temperature Sensor or approved equal
1. Local visual indication of CO_2 levels in enclosed spaces.
2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO_2 levels
3. Bright LED indicator transitions between green, yellow, and red as the CO_2 threshold is exceeded.
a. Accuracy: +/- 30 ppm @ 72°F
b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

PART 3 - EXECUTION

3.1 INSTALLATION

A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.
B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.
C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore, labor allowances should be made for such changes and adjustments if requested.
D. Points listed within this section are to be connected to the BMCS system as hard-wired points to cards and not connected through BacNet integration. The BacNet interface is for read only points not included within sequences of this specification.

3.2 INTERLOCK AND SAFETY CIRCUITS

A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
1. The damper and actuators are specified in this section.
2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
3. Provide motorized outside air dampers for the following:
a. Supply fans
b. AHUs
c. Exhaust fans (except kitchen exhaust)
B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
C. Interlock each chiller to start its dedicated chilled and condenser water pumps. Interlock flow switch and pump auxiliary contacts in series to chiller safety terminal strip.
1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.

2. As per manufacturer's recommendations

D. Primary chilled water control:
1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
2. Provide flow switches located in the chilled water and condenser water piping to each water-cooled liquid chiller.
a) Interlock to prevent operation in the absence of flow.
b) This may not be the prime controller to start/stop the chiller.
c) Interlock thru pump auxiliary contacts.
3. Provide a high limit temperature sensor in each primary chilled water pump loop.

E. Exhaust/Supply Fans:
1. Interlock the related exhaust and supply fans and the related outside air damper.
2. Interlock the exhaust fans with the related air-handling unit through software.
3. Interlock related exhaust fan for dishwasher with time delay off relay.
4. Interlock related exhaust fan for kiln with time delay off relay
5. Interlock kitchen hood related supply and exhaust fans.
6. Provide additional interlocks as indicated on fan schedule and on drawings.
7. Interlock electrical and mechanical room exhaust fans with thermostat.
8. Interlock refrigerant monitor with mechanical room purge system.
9. Interlock science room related supply and exhaust fans.
10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.

F. Freeze Protection:
1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
b. Boilers - Enable during a freeze condition.
c. Chillers – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves. Coordinate with chiller manufacturer to ensure chiller controller and pump control is configured to allow freeze protection cycle to be enabled without a call for cooling
e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.

G. Drain Pan Float Protection:

1. Interlock to shut down unit and close valves.
2. Cooling Coils mounted above ceiling and in roof mounted units.
3. Provide for each cooling coil location.
4. Signal BMCS alarm point

H. Domestic Water System:
1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.

I. Science Room Utility Controllers:
1. Interlock the utility controllers with related air-handling unit through software.

J. Hydronic Heating Boiler:
1. Interlock each boiler to start its dedicated pump.
2. On startup enable boiler prior to starting primary pump. Boiler should reach operating temperature prior to starting system pump as per manufacturer's recommendations.
3. Disable system pump if boiler goes into alarm or fails to produce heating water within 30 minutes.

K. Condensing and Non-Condensing Hot Water Boilers:
1. Interlock each boiler to start its dedicated pump.
2. Install communication cable between each boiler and master controller specified by boiler manufacturer.

3.3 GRAPHICS

A. Furnish as-built drawings indicating final corrected "as installed" diagram(s) of the complete Building Management Control System.
1. Modification of existing control systems shall be included.
2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
3. Provide final sequence of operation in written format.

B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner. Provide electronic copy of as-built record drawings, submittals and closeout documents on thumb drive.

C. Provide a two color-coded floor plan of the building, one representative of the AHU level zones and the other to be representative of the space/temperature sensor level and shall indicate the location of each system, the area served by each AHU and each related zone. Provide both in PDF format and in printed form of professional quality. Printed floor plan is to hang in main mechanical room near central control panel.

D. Provide a separate graphics for each system, site plans including all exterior lighting and parking lot lighting. Graphics shall be a dynamic in nature to provide visual indication of which area of the site currently has lighting energized and de-energized. Areas energized and de-energized shall be indicated with different colors as determined by the school district. In addition, the zone tags shall include the pole number, location of the contactor, panel and circuit number.

E. Provide final graphic room numbers as selected by District. Any graphic changes during the warranty period shall be included.

F. Provide an alarm management and reporting graphical page. This page shall allow user to create, acknowledge and adjust alarms. All alarms shall have the ability to be selectable for remote notifications and control which personnel is notified.

G. System shall provide fully interactive thermal graphic floor plans that include the following features:
1. Dynamic Colored Floor Plans (DCFP) that compare actual space conditions to set points (DCFPs shall utilize a range of colors that represent cool to cold and

warm to hot, and the color scheme shall remain consistent throughout all graphic levels and across all facilities with the entire control system for the District)

2. The DCFP shall be displayed on a single screen for the entire campus or facility with at a minimum large spaces notes on this initial floor plan and additional spaces labeled for each subsequent level, ultimately down to individual room numbers (note: DCFP must continue to all levels, including those needed to display room numbers on the facility floor plan; for example: for a high school, the first level might be the entire facility with gyms, library, auditorium, etc. labeled; the second level might be divided by floor level with additional spaces labeled such as Admin, Kitchen, etc; and the third level might be areas of each floor with individual room numbers) Room numbers must be displayed on a plan level that is legible and acceptable to the owner.
3. Additionally, DCFPs shall also display via a different set of colors the following:
    a. Status changes from Occupied to Unoccupied
    b. When any HVAC equipment is running in either Occupied or Unoccupied Mode (for example: unoccupied dehumidification, etc.), and
    c. Communication losses at any level within the facility
4. At all levels DCFP graphics must include at a minimum the following:
    a. The facility name (to be either adjustable by the user, or to be adjusted by the contractor for the life of the building at no additional charge)
    b. True North label
    c. A facility diagram in the corner showing subsequent levels below the current page (this facility diagram must also include active links to each shown sub-level area)
    d. OA Temp (with a direct link to the point where this information originates)
    e. Name displays of and active links to each of the following:
        1) Each CHW plant that serves this facility (each one labeled by name with links to the corresponding CHW graphic), and the display of the CHW Supply Temperature from this plant
        2) Each HHW plant that serves this facility (each one labeled by name with links to the corresponding HHW graphic), and the display of the HHW Supply Temperature from this plant
        3) Emergency Shutdown (showing current status and link to the corresponding enable/disable location)
        4) Freezer and/or Cooler temperatures
        5) AHU Summary Pages
        6) Zone and/or Box Summary Pages
5. Provide preprogrammed summary pages as provided by the owner.

H. System shall include a graphical page that contains building and system related documents stored for ease of remote access.

I. System shall include a real time dynamic dashboard to provide real time analysis of conditions and equipment performance.

J. Graphics shall clearly display % open from 0-100% on all valves and dampers.

K. Graphics shall clearly display % run from 0-100% for all VFDs. Displaying current operating hertz only is not acceptable.

L. All graphics must reside on main system front end server. Graphics shall not be stored on controllers.

3.4 IDENTIFICATION

A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.

B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high,

engraved letters.

C. Provide a black and white label affixed to the ceiling grid below all terminal units and labeled with the unit tag with those used on the "as installed" control diagrams. Coordinate labeling with nomenclature used on the diagrams.

D. Provide each valve and damper actuators labeled with room served and zone number.

E. Provide each sensor with label located on the inside of sensor cover. The label shall indicate which device sensor is controlling. If multiple sensors control a single device the sensors shall be labeled with an “A” or “B” etc.

F. Provide identification label located on the ceiling grid to indicate location of each terminal box. Label shall identify the terminal box number.

G. Provide identification label on each transformer and relay with what devices they serve and their function.

H. Provide identification label on each wire used for this system. Labels shall be affixed to each end of the wire.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.

B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
   1. Wiring of interlock system.
   2. Wiring of control instruments.
   3. Wiring of control panels.
   4. Wiring of related power supplies, i.e. transformers.
   5. Wiring of 120 VAC power circuits for control panels and devices.

C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.

D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.

E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.

F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.

G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridle rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5’ centers and identified at each termination point and at 50’ centers minimum. Install wire parallel or perpendicular to the structural features of the building.

H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.

I. All wiring associated with building management and control system cover shall be as follows:
   1. Sensor jacket color, Yellow
   2. LAN communications, Yellow
   3. All THHN wiring shall comply with Division 26 insulation color identification

3.6 EXISTING AUTOMATION SYSTEM

A. The new system components shall be fully integrated with the existing Building Automation System Host computer located at the School District maintenance facility.

B. The integrating shall include, but not be limited to, database additions, creation of graphics and implementing communications. Integration shall be consistent with District standards and practices.

C. The bid for the control work shall be based on the premise that existing control devices are operational and are not in need of repair or replacement, unless otherwise noted.

D. This subcontractor shall notify the Owner's representative of existing control devices that need to be replaced or repaired that may be noted in the process of installation of the new work.

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3.7 EXHAUST AND SUPPLY FANS

A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.

B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.

C. Provide by-pass timers for fans indicated in Fan Schedule and in the following locations:
1. Fume Hoods
2. Science Room exhaust fans

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay

3.8 MISCELLANEOUS

A. Terminal Unit relocation – This contractor shall remove and reinstall all new controls to support terminal unit relocation. This work shall include all new communication wiring and sensor wiring.

B. Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

3.9 VARIABLE FREQUENCY DRIVE INTERFACE

A. Interface to the VFD directly

B. Interface may be hardwired or via RS-485

C. The following points shall be available at a minimum:

Point Name	Type
Start-stop	DO

Drive alarm		DI
Last fault		AI
Reset drive		DO
Percent output		AI
Frequency output	AI	
Speed		AI
Current		AI
Power		AI
Drive temperature	AI	
KWH		AI
Run time	AI	

3.10 VARIABLE AIR VOLUME TERMINAL UNIT COORDINATION

A. Equipment furnished in this section and installed by Section 23 36 16:
   1. Automatic temperature control card (DDC).
   2. Damper Actuator

B. Equipment furnished and installed by Section 23 36 16:
   1. Damper.
   2. Multi-point flow sensor.
   3. Power transformer.
   4 Controller enclosure.

3.11 HYDRONIC HOT WATER HEATING SYSTEM

A. This system consists of two (2) condensing hot water boilers with constant flow primary boiler pumps and two (2) variable flow hot water secondary pump. Control of the hydronic hot water heating system is as follows:
   1. Energize the hydronic hot water heating system whenever there is a call for heating in the building.
      a. Monitor all control valves to determine if a heating requirement exists.
   2. Energize the hybrid sequence controller specified elsewhere.
      a. The hybrid sequence controller shall control all functions and sequencing of the hot water heating boilers.
      b. Connect all boilers to the master boiler controller specified elsewhere with communication cable as required.
   3. Hydronic hot water heating system supply temperature reset.
      a. A temperature sensor sensing outdoor temperature shall provide an input to the hybrid sequence controller to reset the hot water supply temperature.
         1) Maintain 160°F (adjustable)supply water temperature whenever the ambient temperature is 20°F and below.
         2) Maintain 110°F (adjustable) supply water temperature whenever the ambient temperature is 60°F and above.
         3) All reset temperatures shall be adjustable through the BMCS.
   4. Secondary hot water pump control:
      a. A system differential pressure sensor shall modulate the hot water pump variable frequency drives and stage pumps A and B to maintain system differential pressure.
      b. This system shall be completely adjustable in the field.

POINT DESCRIPTION	TYPES	DEVICE

POINT DESCRIPTION	TYPES	DEVICE
Hybrid Sequence Controller	DO	Control Relay
Boiler Alarm Status	DI	Safety Relay (Each Boiler)
Secondary Hot Water Pump Start/Stop/Modulation	AO	Variable Frequency Drive (Each Pump)
Pump Status	DI	Current Sensitive Relay
Building Hot Water Supply/Return Temperature	AI	Pipe RTD
Boiler Discharge Water Temperature	AI	Pipe RTD (Each Boiler)
Ambient Temperature	AI	Thermistor
Boiler Supply Water Reset	AO	Hybrid Sequence Controller
Inlet Temperature (Read Only		Bacnet Card (Each Boiler)
Outlet Temperature (Read Only)		Bacnet Card (Each Boiler)
Header Temperature (Read Only)		Bacnet Card (Each Boiler
Boiler State (Read Only)		Bacnet Card (Each Boiler)
Error Code (Read Only)		Bacnet Card (Each Boiler)

3.12 HYDRONIC AND DOMESTIC BOILER EMERGENCY VENTILATION SYSTEM

A. Interface with the CO monitor system. Upon alarm through the sensor the boiler room emergency exhaust fan shall be activated. Upon alarm, through the sensor, all the boiler equipment, i.e. boiler and pumps and domestic water heaters, shall be deactivated. CO monitor shall provide a visual and audible alarm. Provide a sign at each entrance to boiler room to indicate information about system.

B. Upon Alarm of CO monitor, notify users via text message.

POINT DESCRIPTION	TYPES	DEVICE
CO Monitor	DI	Control Panel
Fan Start/Stop	DO	Control Relay
System Start/Stop	DO	Control Relay

3.13 CHILLED WATER SYSTEM CONTROL

A. A new air-cooled chiller is being added and connected to the existing water-cooled central plant that utilized primary secondary pumping. The existing controls system shall be updated to reflect all changes to the system including a new graphics package.

B. The final system consists of two existing water-cooled chillers and a new air-cooled chiller. The new air-cooled chiller shall have a dedicated primary chilled water pump. Chilled water system shall be activated by a request for cooling from any unit it supplies with chilled water during the plant scheduled operating hours. The number of requests required to activate the plant shall be user adjustable.

C. Temperature sensors located in the building common chilled water supply and return piping and the turbine flow meter located in the building chilled water common supply piping shall, acting through the DDC system, be used to calculate the building BTUH requirements.

D. Water Cooled Chiller 1 with its respective pump shall be System 1. Water Cooled Chiller 2 with its respective pump shall be System 2. Air Cooled Chiller 3 with its respective pump shall be System 3.

E. During start-up, System 3 primary pump shall start. After flow has been indicated from the flow switch for an adjustable time period, the System 3 chiller shall be activated.

F. When the load calculated from the temperature sensors and flow meter exceeds the capacity of System 3 for an adjustable time period, the System 1 primary pump and chiller shall be activated. Upon activation of System 1, System 3 shall be deactivated. Upon further increase of building load, System 2 shall activated to run with System 1. System 3 shall also be a peak load machine and utilized as such within the sequence.

G. Stage down of plant shall be in the reverse order of stage up. The primary pumps serving the chillers will remain on for 3 minutes (adjustable) and then be deactivated.

H. A temperature sensor located in the chiller by-pass piping shall send an alarm to the host computer and shall start the lag chiller after an adjustable time delay, if the temperature in the by-pass is above 3 (adjustable) higher than the temperature in the common supply from the chillers. This indicates the flow is moving from the primary loop to the secondary loop.

I. Provide time delays between pump starts and stops to allow system to stabilize.

J. Change lead/lag rotation on a weekly basis.

K. Provide full BacNet integration for each chiller. Provide a separate graphics page to display all information (Adjustable) available from BacNet card.

L. Interface with existing Bacnet card. All BacNet points shall be exposed in BMCS system and at a minimum display those listed below on a graphical page.

POINT DESCRIPTION	TYPES	DEVICE
AC Chiller Start/Stop	DO	Control Relay
AC Chiller Water Supply Temperature	AI	Pipe RTD (1 each)
AC Status (Chiller)	DI	Safety Alarm Relay
AC Pump Status	DI	Current Sensitive Relay
Building Flow	AI	Turbine Flow Meter
Building Supply/Return Water Temp.	AI	Temperature Sensors
Bypass Temperature	AI	Temperature Sensor
Common Chiller Supply Temperature	AI	Temperature Sensor
Common Chiller Return Temperature	AI	Temperature Sensor
Chilled Water Setpoint	AO	BacNet Card
Current Limit Setpoint	AO	BacNet Card
Compressor Starts (Per compressor	AI	BacNet Card

POINT DESCRIPTION	TYPES	DEVICE
Compressor Runtime (Per compressor	AI	BacNet Card

3.14 SECONDARY CHILLED WATER PUMPING SYSTEM CONTROL

A. The secondary chilled water pumps and variable frequency drives are being replaced.

B. The existing pump control sequence shall remain in place. Provide new end devices as listed below.

POINT DESCRIPTION	TYPES	DEVICE
Pump Start/Stop	DO	Control Relay
Pump Status	DI	Differential Pressure Switch
Pump Speed	AO	Variable Frequency Drive

3.15 FAN COIL UNITS (FCU-1 through FCU-9)

A. Each fan coil unit is furnished with a chilled water coil and hot water coil. Control shall be as follows:

1. A space temperature sensor shall, acting through a terminal equipment controller, modulate the valves on the chilled water cooling coil and hot water reheat coil in sequence to maintain the desired space temperatures.
2. Start/stop of fan coil unit shall be by terminal equipment controller.
3. The outside air units providing the outside air shall be activated when the fan coil units are operating during the occupied periods.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
CHW Valve	AO	Electronic Operator
FCU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
HW valve	AO	Electronic Operator
Discharge Air Temperature	AI	Duct Thermistor
Outside Air Damper	DO	Electronic Operator (where applicable)

3.16 ROOF MOUNTED SINGLE ZONE VARIABLE AIR VOLUME AIR HANDLING UNIT (RMAHU-1)

A. This unit is furnished with a chilled water coil, a hot water heating coil in the reheat position, and a variable frequency drive. Control shall be as follows:

1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified. A chilled water coli leaving air temperature sensor through the Direct Digital Control

Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at the minimum speed and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil to incrementally reset the chilled water leaving air temperature up to a maximum temperature of 60F. Only after the fan is at minimum speed and the chilled water leaving air temperature is at the max should the valve on the hot water coil be modulated to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil discharge temperature reset and the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
Reheat HW Valve	AO (1)	Electronic Operator
CHW Valve	AO (1)	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor
Fan Speed	AO	Variable Frequency Drive
Space Humidity	AI	Humidity Sensor

3.17 SINGLE ZONE VAV AIR HANDLING UNIT WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-3/AHU-3A)

A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
   1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled. The supply fan shall be started and stopped from the BMCS System.
   2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.

3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.
4. A space CO2 sensor shall monitor space CO2 levels. The outside air supply fan shall be modulate as required to maintain less than 500 PPM (adjustable).
5. CO2 control shall not apply to Air Handling Unit serving the Kitchen.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Variable Speed Fan	AO	Motor Controller
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Heating Coil Leaving Air Temp.	AI	Averaging Sensor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator
CO2 Concentration	AI	Space CO2 Sensor

B. This unit is furnished with a chilled water coil, a hot water heating coil in the reheat position, and a variable frequency drive. Control shall be as follows:
1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified. A chilled water coli leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at the minimum speed and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil to incrementally reset the chilled water leaving air temperature up to a maximum temperature of 60F. Only after the fan is at minimum speed and the chilled water leaving air temperature is at the max should the valve on the hot water coil be modulated to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil discharge temperature reset and the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

POINT DESCRIPTION	TYPES	DEVICE

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
Reheat HW Valve	AO (1)	Electronic Operator
CHW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor
Fan Speed	AO	Variable Frequency Drive
Space Humidity	AI	Humidity Sensor

3.18 SINGLE ZONE AIR HANDLING UNITS CONTROL W/VARIABLE FREQUENCY DRIVE (AHU-1, AHU-2)

A. This unit is furnished with a chilled water cooling coil, a hot water reheat coil, and a variable frequency drive. Control shall be as follows:

1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified or to the outside air percentage whichever value is larger. A chilled water coil leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at minimum speed of its specified air quantity and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil and the valve on the hot water coil in sequence to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

B. Outside air for these units are being provided pretreated from a separate Outside Air Unit via an Outside Air Variable Air Volume Terminal Unit.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Fan Speed	AO	Variable Frequency Drive
Space Temperature	AI	Space Thermistor

POINT DESCRIPTION	TYPES	DEVICE
Space Humidity	AI	Humidity Sensor
CHW Valve	AO (1)	Electronic Operator
Reheat HW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor

3.19 OUTSIDE AIR HANDLING UNIT CONTROL (OAFCU-1)

A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position and serve a single zone air handling unit. Control shall be as follows:

1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as indicated on the air handling unit schedule. The air-handling unit shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
3. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.
4. A space CO2 sensor, where indicated, shall through the terminal equipment controller, modulate the fan speed to maintain setpoint (adjustable).

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Variable Speed Motor	AO	Motor Controller
Cooling Coil Discharge Air Temp.	AI	Averaging Probe
Heating Coil Discharge Air Temp.	AI	Averaging Probe
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
CO_2 Concentration	AI	CO_2 Monitor

3.20 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT CONTROL (OAU-1)

A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:

1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature. Reference drawing schedule for discharge temperature.
   The air-handling unit shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
3. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

B. Variable air volume control:

1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
   a. Transmit a signal to the supply fan motor speed controller.
   b. Modulate the fan speed to maintain the desired static pressure.
   c. Coordinate signal with the fan motor speed controller.
3. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Duct Thermistor
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

a. Manual reset. POINT DESCRIPTION	TYPES	DEVICE
Variable Speed Motor	AO	Motor Controller
Static Pressure	AI	Static Pressure Sensor
High Static Limit	DI	High Static Limit Switch

3.21 OUTSIDE AIR VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of a pressure independent variable volume damper. The terminal unit's damper shall be interlocked with the associated OAU supply fan.

1. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position. This information shall be displayed on the terminal unit graphics page.
2. A space CO2 sensor associated with the AHU being served by the OAVAV terminal unit shall provide input to the central BMCS controller. The BMCS shall monitor CO2 levels of the zones served by the associated air handling unit and modulate the pretreated outside air damper to maintain set point 800 PPM (adjustable). This feature shall be user selectable on the AHU graphic page.
3. Terminal units serving VAV Air Handling Units shall not be provided with CO2 control. These unit shall modulate to maintain the scheduled OA CFM during all occupied times.

POINT DESCRIPTION	TYPES	DEVICE
Primary Air	AO	Variable Volume Damper Operator
Discharge Air Temperature	AI	Duct Thermistor
CO2 Concentration	AI	CO2 Sensor

3.22 KITCHEN EXHAUST AND SUPPLY AIR SYSTEM (KEF-1, KEF-2, KEF-3, KEF-4, RMUA-1, VAV-K1 THROUGH VAV-K4)

A. This system consists of a kitchen hood exhaust and variable air volume roof mounted make up air unit each with variable frequency drives. Control shall be as follows:

1. A stainless-steel thermistor (high temp rated) mounted in exhaust collar, sensing exhaust air temperature shall, acting through the Direct Digital Control Panel, compare temperature to room temperature. Exhaust fan shall be activated when a temperature differential of 20°F (adjustable) is detected and be modulated via the VFD to 50% max speed. Upon differential temperature increase, increment the exhaust fan speed up. The speed shall be incremented up with temperature differential until max speed setpoint is reached.
2. The kitchen variable air volume terminal units shall be interlocked with the associated RMUA supply fan and track the kitchen exhaust fans to maintain schedule offset between exhaust and supply air volumes as scheduled.
3. The kitchen roof mounted make up air unit is furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
   a. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain

the desired discharge air temperature. Reference drawing schedule for discharge temperature. The air-handling unit shall be started and stopped from the BMCS System.

b. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.

c. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

4. Variable air volume control:

a. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.

b. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:

1. Transmit a signal to the supply fan motor speed controller.
2. Modulate the fan speed to maintain the desired static pressure.
3. Coordinate signal with the fan motor speed controller.

c. Install a static pressure high limit safety device to de-energize the system.

B. System shall have the capability to be operated from both local switch and schedule. During unoccupied times, the system shall be set to operate at a high temperature differential to prevent unintended activation of the system.

C. Upon activation of the hood suppression system, the exhaust fan shall be activated or continue to run, the kitchen roof mounted make up air unit shall be deactivated. The activation of the fire suppression system shall be sent to activate the shunt trip breaker.

POINT DESCRIPTION	TYPES	DEVICE
Exhaust Fan Start/Stop	DO	Control Relay
Exhaust Fan Status	DI	Current Sensitive Relay
Exhaust Fan Variable Speed Motor	AO	Motor Controller
RMUA Fan Start/Stop	DO	Control Relay
RMUA Status	DI	Current Sensitive Relay
RMUA Fan Variable Speed Motor	AO	Motor Controller
Exhaust Temperature	AI	S.S. High Temp. Duct Thermistor
Discharge Air Temperature	AI	Duct Thermistor
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor

POINT DESCRIPTION	TYPES	DEVICE
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator
Static Pressure	AI	Static Pressure Sensor
High Static Limit	DI	High Static Limit Switch
Kitchen VAV Primary Air	AO	Variable Volume Damper Operator

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3.23 MISCELLANEOUS

A. Terminal Unit relocation – This contractor shall remove and reinstall all new controls to support terminal unit relocation. This work shall include all new communication wiring and sensor wiring.

B. Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

3.24 VARIABLE FREQUENCY DRIVE INTERFACE

A. Interface to the VFD directly
B. Interface may be hardwired or via RS-485
C. The following points shall be available at a minimum:

Point Name	Type
Start-stop	DO
Drive alarm	DI
Last fault	AI
Reset drive	DO
Percent output	AI
Frequency output	AI
Speed	AI
Current	AI
Power	AI
Drive temperature	AI
KWH	AI
Run time	AI

3.25 VARIABLE AIR VOLUME TERMINAL UNIT COORDINATION

A. Equipment furnished in this section and installed by Section 23 36 16:
   1. Automatic temperature control card (DDC).
   2. Damper Actuator
B. Equipment furnished and installed by Section 23 36 16:
   1. Damper.
   2. Multi-point flow sensor.
   3. Power transformer.
   4 Controller enclosure.

3.26 CHILLED WATER SYSTEM CONTROL

A. The existing air-cooled chiller and its associated primary chilled water pump is being replaced with new. This contractor shall remove all existing sensors, wiring and conduit that will be affected by the equipment replacement and provide and install new end devices, conduit and wiring to replace those removed. The existing control sequence shall remain in place. Provide contractor startup assistance and controls commissioning of new equipment and devices.
B. Provide interface to each chiller through the chiller BacNet card. Provide a graphic page for the interface card that displays all values available or those as required by owner.

3.27 ROOF MOUNTED SINGLE ZONE VARIABLE AIR VOLUME AIR HANDLING UNIT (RMAHU-1)

A. This unit is furnished with a chilled water coil, a hot water heating coil in the reheat position, and a variable frequency drive. Control shall be as follows:
   1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified. A chilled water coli leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at the minimum speed and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil to incrementally reset the chilled water leaving air temperature up to a maximum temperature of 60F. Only after the fan is at minimum speed and the chilled water leaving air temperature is at the max should the valve on the hot water coil be modulated to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil discharge temperature reset and the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
Reheat HW Valve	AO (1)	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
CHW Valve	AO (1)	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor
Fan Speed	AO	Variable Frequency Drive
Space Humidity	AI	Humidity Sensor

3.28 SINGLE ZONE VAV AIR HANDLING UNIT WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-3/AHU-3A)

A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:

1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled. The supply fan shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.
4. A space CO2 sensor shall monitor space CO2 levels. The outside air supply fan shall be modulate as required to maintain less than 500 PPM (adjustable).
5. CO2 control shall not apply to Air Handling Unit serving the Kitchen.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Variable Speed Fan	AO	Motor Controller
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Heating Coil Leaving Air Temp.	AI	Averaging Sensor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator
CO2 Concentration	AI	Space CO2 Sensor

B. This unit is furnished with a chilled water coil, a hot water heating coil in the reheat position, and a variable frequency drive. Control shall be as follows:

1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified. A chilled water coli leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at the minimum speed and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil to incrementally reset the chilled water leaving air temperature up to a maximum temperature of 60F. Only after the fan is at minimum speed and the chilled water leaving air temperature is at the max should the valve on the hot water coil be modulated to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil discharge temperature reset and the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
Reheat HW Valve	AO (1)	Electronic Operator
CHW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor
Fan Speed	AO	Variable Frequency Drive
Space Humidity	AI	Humidity Sensor

3.29 SINGLE ZONE AIR HANDLING UNITS CONTROL W/VARIABLE FREQUENCY DRIVE (AHU-1, AHU-2)

A. This unit is furnished with a chilled water cooling coil, a hot water reheat coil, and a variable frequency drive. Control shall be as follows:

1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified or to the outside air percentage whichever value is larger. A chilled water coil leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at minimum speed of its specified air quantity and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil and the valve on the hot water coil in sequence to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

C. Outside air for these units are being provided pretreated from a separate Outside Air Unit via an Outside Air Variable Air Volume Terminal Unit.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Fan Speed	AO	Variable Frequency Drive
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Humidity Sensor
CHW Valve	AO (1)	Electronic Operator
Reheat HW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor

3.30 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT CONTROL (OAU-1)

A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:

1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature. Reference drawing schedule for discharge temperature.
   The air-handling unit shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the

temperature drops below 32°F. Device shall be manual reset.

3. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

B. Variable air volume control:

1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
   a. Transmit a signal to the supply fan motor speed controller.
   b. Modulate the fan speed to maintain the desired static pressure.
   c. Coordinate signal with the fan motor speed controller.
3. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Air Temperature	AI	Duct Thermistor
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator
Variable Speed Motor	AO	Motor Controller
Static Pressure	AI	Static Pressure Sensor
High Static Limit	DI	High Static Limit Switch

3.31 OUTSIDE AIR VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of a pressure independent variable volume damper. The terminal unit's damper shall be interlocked with the associated OAU supply fan.

1. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position. This information shall be displayed on the terminal unit graphics page.
2. A space CO2 sensor associated with the AHU being served by the OAVAV terminal unit shall provide input to the central BMCS controller. The BMCS shall monitor CO2 levels of the zones served by the associated air handling unit and modulate the pretreated outside air damper to maintain set point 800 PPM

(adjustable). This feature shall be user selectable on the AHU graphic page.

3. Terminal units serving VAV Air Handling Units shall not be provided with CO2 control. These unit shall modulate to maintain the scheduled OA CFM during all occupied times.

POINT DESCRIPTION	TYPES	DEVICE
Primary Air	AO	Variable Volume Damper Operator
Discharge Air Temperature	AI	Duct Thermistor
CO2 Concentration	AI	CO2 Sensor

3.32 CONSTANT VOLUME / VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of a pressure independent variable volume damper, a constant volume fan, and a hot water heating coil. The fans shall be interlocked with the AHU fan. Constant volume terminal shall start before AHU fan starts. Controls shall be as follows:

1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper from full open to a minimum airflow rate to maintain room setpoint. If heating is required, the temperature sensor shall modulate the hot water control valve to maintain room setpoint with the variable volume damper in the minimum airflow position.
2. Control valve, and control valve operator are specified in this section.
3. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, damper position, and hot water valve position.

POINT DESCRIPTION	TYPES	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air	AO	Variable Volume Damper Operator
HW Valve	AO	Electronic Operator
Start/Stop	DO	Control Relay
Discharge Air Temperature	AI	Duct Thermistor

3.33 KITCHEN EXHAUST AND SUPPLY AIR SYSTEM (KEF-1, KEF-2, KEF-3, KEF-4, RMUA-1, VAV-K1 THROUGH VAV-K4)

A. This system consists of a kitchen hood exhaust and variable air volume roof mounted make up air unit each with variable frequency drives. Control shall be as follows:

1. A stainless-steel thermistor (high temp rated) mounted in exhaust collar, sensing exhaust air temperature shall, acting through the Direct Digital Control Panel, compare temperature to room temperature. Exhaust fan shall be activated when a temperature differential of 20°F (adjustable) is detected and be modulated via the VFD to 50% max speed. Upon differential temperature increase, increment the exhaust fan speed up. The speed shall be incremented up with temperature differential until max speed setpoint is reached.
2. The kitchen variable air volume terminal units shall be interlocked with the

associated RMUA supply fan and track the kitchen exhaust fans to maintain schedule offset between exhaust and supply air volumes as scheduled.

3. The kitchen roof mounted make up air unit is furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
   a. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature. Reference drawing schedule for discharge temperature. The air-handling unit shall be started and stopped from the BMCS System.
   b. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the chilled water and hot water valve 100%, start the boiler and hot water and chilled water pumps, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
   c. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.
4. Variable air volume control:
   a. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
   b. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
      1. Transmit a signal to the supply fan motor speed controller.
      2. Modulate the fan speed to maintain the desired static pressure.
      3. Coordinate signal with the fan motor speed controller.
   c. Install a static pressure high limit safety device to de-energize the system.

B. System shall have the capability to be operated from both local switch and schedule. During unoccupied times, the system shall be set to operate at a high temperature differential to prevent unintended activation of the system.

C. Upon activation of the hood suppression system, the exhaust fan shall be activated or continue to run, the kitchen roof mounted make up air unit shall be deactivated. The activation of the fire suppression system shall be sent to activate the shunt trip breaker.

POINT DESCRIPTION	TYPES	DEVICE
Exhaust Fan Start/Stop	DO	Control Relay
Exhaust Fan Status	DI	Current Sensitive Relay
Exhaust Fan Variable Speed Motor	AO	Motor Controller
RMUA Fan Start/Stop	DO	Control Relay
RMUA Status	DI	Current Sensitive Relay
RMUA Fan Variable Speed Motor	AO	Motor Controller

POINT DESCRIPTION	TYPES	DEVICE
Exhaust Temperature	AI	S.S. High Temp. Duct Thermistor
Discharge Air Temperature	AI	Duct Thermistor
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator
Static Pressure	AI	Static Pressure Sensor
High Static Limit	DI	High Static Limit Switch
Kitchen VAV Primary Air	AO	Variable Volume Damper Operator

3.34 START-UP AND POINT VERIFICATION

A. Final startup and point verification shall include the following information. **All work described in this section shall occur at initial installation and at 11-month warranty walk.**

1. Field panel checkout:
   a. Verify enclosure is not mounted on vibrating surface.
   b. Verify class I and class II wiring is separated within enclosure.
   c. Check for shorts/grounds/induced voltages/proper voltages.
   d. Verify proper point terminations in accordance with as-builts.
   e. Verify that all modules are in proper place and addressed.
   f. Verify proper power voltage.
   g. Load database and programming.
   h. Startup the panel.
   i. Point and device checkout.
2. Analog input point checkout:
   a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
   b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
   c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.

d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.

3. Digital input point checkout:
   a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
   b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
   c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
   d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
   e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
4. Digital output point checkout:
   a. Verify that device is correctly wired and terminated as shown in the design documentation package.
   b. Verify that the correct voltage is utilized in the circuit.
   c. Verify the point database to be correct (i.e. point name, address, etc.).
   d. Check and verify that the end device responds appropriately to the digital output(s).
   e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
   f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
   g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
5. Analog output point checkout:

a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.

6. Terminal equipment controller checkout:
   a. Load program database
   b. Enable programs
   c. Verify sequence of operations
7. Programming checkout:
   a. Provide checkout for each system and sequence of operation.
   b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.
   c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
   d. Input to Trigger Test: Change discharge temperature high alarm limit

through software to a value below the current discharge temperature (discharge temperature - 10°F).

e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.

f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.

8. Workstation checkout:

a. Verify the operation of all trunk interface equipment.

b. Verify all workstation software, including options, based upon the installation instructions for the PC.

c. Perform software backup (site, options, etc.)

d. Complete workstation configuration report for owner signoff.

e. Provide verification that all graphics have been created, as required by project bid documents.

3.35 TESTING AND ACCEPTANCE

A. General:

1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.

a. Follow in the order specified.

b. Each testing phase shall be satisfactorily completed before entering the next phase.

2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.

3. Submit for approval, a sample of the form on which the test will be reported.

a. Identify project.

b. Provide a list of all points, arrange in numerical order of point addresses.

1) Show point descriptor and location of each.

2) Indicate DDC panel that processes each point.

3) Use the list as a basis for the specified report form.

c. Signatures of participants and observers.

d. Results.

e. Description of adjustment or corrections of points in error.

f. Date.

4. Provide schedule of tests. Estimate dates of significant events.

5. Test, calibrate and adjust each point in the system as specified.

6. Provide documentation of all tests and verifications as specified.

7. Provide trend reports indicating proper control of all points for an extended period of time.

B. Phase 1 - Testing, Calibrating, and Adjusting:

1. Operate each analog point in the entire system.

a. At a point in the upper quarter of its range.

b. At a point in the lower quarter of its range.

c. At its operating point.

2. Provide personnel and diagnostic instruments at both the central and remote locations.

3. Provide testing stimulants for alarms.

4. Use digital meters of double the accuracy of the instruments being calibrated.

5. Provide an approved test device for simulating high and low temperatures.

6. When the function is performed, read values at the central control and observe the actual function at the field instrument.

7. Exercise each binary point and observe indication at console and simultaneously

observe operation in the field.

8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
9. Test all power transducers with a Dranetz Power Analyzer.

C. Phase 2 - Equipment and Point Verification:
1. Verify calibration or function of each point.
   a. Verify analog points at operating value.
   b. Record on specified form.
   c. Make approved adjustments to out of tolerance points.
      1) Identify these points for ready reference.
2. After verification procedure in completed:
   a. Verify corrected points.
   b. Record on specified form.
   c. Points requiring correction.
      1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.

D. Phase 3 - Software Verification:
1. Submit agenda and report format for software demonstrations.
2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
3. Demonstrate compliance with response time specifications.
   a. Simulate normal heavy load conditions.
   b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
4. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.

E. Provide the following reports to Engineer at final completion of all Testing:
1. List of all points.
2. List of all points currently in alarm.
3. List of all disabled points.
4. List of all points in over-ride status.
5. List of all points currently locked out.
6. List of user accounts and access levels.
7. List all weekly schedules.
8. List of holiday programming schedules.
9. List of limits and deadbands.
10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
11. List of programs.
12. Provide trend data reports to ensure proper operation and sequence control of BMCS.

F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.36 TRAINING

A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

B. Provide 40 hours of training for Owner's designated operating personnel. Training shall

include:
Explanation of drawings, operations and maintenance manuals
Walk-through of the job to locate control components
Operator workstation and peripherals
DDC controller and ASC operation/function
Operator control functions including graphic generation and field panel programming
Operation of portable operator's terminal
Explanation of adjustment, calibration and replacement procedures
Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.37 PROJECT MANAGEMENT

A. Provide a designated project manager who will be responsible for the following:
1. Construct and maintain project schedule.
2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
3. Attend project meetings as necessary to avoid conflict and delays.
4. Make necessary field decisions relating to this section.
5. Coordination / Single point contact.
6. Have Internet access for project management.

END OF SECTION

SECTION 23 0934
COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Building Management and control System for the facility shall be furnished and installed under a separate contract. The items listed below shall be furnished and/or installed by this contractor.

PART 2 - PRODUCTS

A. Products provided by the Building Management and Control System (BMCS) Contractor.
   1. Control Valves
   2. Dampers
   3. Wells for sensors installed in piping system
   4. Flow Meters

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with the Building Management and Control System (BMCS) Contractor.
   1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
   2. Schedule periodic project meetings to review progress and coordination issues.
   3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.

B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

A. This Contractor will be responsible for the following:
   1. Installation of control valves for HVAC equipment.
   2. Installation of dampers for HVAC equipment.
   3. Installation of temperature sensor wells in piping.
   4. Installation of pressure taps in piping system.
   5. Installation of flow meter taps in piping system.

B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION

SECTION 23 2000
HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

A. Division 23 Mechanical:
   1. Earthwork.
   2. Valves, Strainers and Vents.
   3. Vibration Isolation.
   4. Insulation.
   5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. 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.

C. Solder joints.
   1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
   1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
   2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
   3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
   4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
   5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges

on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:

1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.

1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. 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.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering

is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.

B. Provide supports both sides and within 12” of each horizontal elbow for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2” minimum vertical adjustment.

F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Provide hangers within 3' of pipe length from all coil connections.

I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6	5	3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with

mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. 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. Flush the chilled and hot water systems utilizing the filter feeders.

B. 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 strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances 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.

D. 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.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.

G. Phase Three: Final flushing and rinsing: 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.

H. Submit status reports upon completion of each phase of work on each system.

I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
C. Install identification in the following locations:
    1. both sides of penetrations through walls, floors and ceilings.
    2. Close to valves or flanges.
    3. Intervals on straight pipe runs not to exceed 50 feet
    4. Apply marker where view is obstructed.
D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 23 2113
HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

A. Division 23 Mechanical:
   1. Pipe and Pipe Fittings - General
   2. Valves, Strainers and Vents
   3. Vibration Isolation
   4. Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 standard weight seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.

B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 standard weight seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

A. Refer to Section 23 05 23.

B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

A. Pressurized Expansion Tanks shall be precharged steel tank with a replaceable heavy duty Butyl rubber bladder. The tank shall have a 1-1/2" system connection, drain, and a standard tire valve to facilitate on-site charging of the tank. The tank shall be fitted with lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure.
   1. Acceptable manufacturers: Bell & Gossett, Taco, Wessels, John Wood Company, and Wheatley.

B. Air Separators shall be centrifugal type. The inlet and outlet connections shall be the same as adjoining pipe. Vessel shell diameter is to be three times the nominal inlet/outlet pipe diameter. The unit shall have an internal stainless steel air collector tube with perforations and 63% open area designed to direct accumulated air to the compression tank via a vent connection at top of unit. The air separator must be designed, constructed and stamped for 125 psig @ 350°F in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one shop coat of light gray air dry enamel. A Manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code shall be furnished for each air separator upon request.
   1. Acceptable manufacturers: Bell & Gossett, Armstrong, Taco, John Wood Company, and Wheatley.

C. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal

system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.
1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

D. Pressure Reducing Valves shall be diaphragm operated with brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer, and stem must be removable and of non-corrosive material.
1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

PART 3 - EXECUTION

3.1 TESTING

A. Test all piping systems to assure they are absolutely leak free.

B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

3.2 AIR HANDLING UNIT PIPING

A. Provide a minimum of 12" of straight pipe at all coil piping connections.

3.3 AIR SEPARATOR

A. Install full size drain to nearest floor drain.

END OF SECTION

SECTION 23 2123
HVAC PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General characteristics for pumps specified in Division 23 - Mechanical.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 23 - Mechanical, including the following:

A. Division 23 Mechanical - Electrical Provisions of Mechanical Work.

1.3 PUMP SELECTION

A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.

B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.

C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.

D. The pump curve shall rise continuously from maximum flow to cut-off.

E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.

F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.

G. Select the pump for operation at or near peak efficiency.

H. Cavitation-free at all points on the curve.

I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

J. Pumps shall be suitable for parallel operation. Where pumps are operated in parallel, individual pumps shall be capable of stable operation with only one pump operating in the system. Submit pump curves with single and multiple pumps operating on system curve for approval.

1.4 PUMP SIZE AND TYPE

A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

B. The head capacities indicated in the schedules are listed for bidding purposes only. Calculate the operating head at each pump; take into consideration the actual routing of the various lines, pressure drops in heat exchangers and coils, exact lengths of pipe, fittings, etc. Submit these calculations, together with copies of manufacturer’s performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. When multiple pumps are operating in parallel, show pump curves for one pump running, two pumps running, and so on. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 VERTICAL IN-LINE (VIL) PUMPS

A. Pump Construction:

1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
4. Shaft: Provide stainless steel pump shaft.
5. Coupling: Totally enclosed metal or high-impact polyethylene plastic (Orange Peel) coupling guard per ANSI B15.1, Section 8 and OSHA 1910.219. Coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
6. Mechanical seals shall be stainless steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel glad plate. Provide factory installed flush line with manual vent.
7. Split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positive cooling and lubrication.
8. Provide seal flush supply line to the mechanical seal with a 50 micron cartridge filter and sight flow indicator to suit the working pressure encountered. Filters shall be changed by the installing contractor after system is flushed and on a regular basis until turned over to the Owner.
9. Supply in the flush line to the mechanical seal a maintenance free sediment separator with sight flow indicator.
10. Volute shall include gauge ports at nozzles, and vent and drain ports.

B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.

C. Pump Motor:

1. Premium efficiency
2. Totally enclosed fan cooled
3. Cast iron frame and end plate
4. (2) Forge steel lifting eye
5. Over-sized conduit box with ground lug
6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve.
7. Critical speed of the pump shall be at minimum 115% of the operating speed listed in the pump schedule.
8. Designed for Variable Frequency Drive Application
9. Greaseable bearings rated for a minimum of 200,000 hours.
10. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%

30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

D. Data plates:
1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
2. Locate the nameplate for easy visibility.
3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
a. Manufacturer, address, telephone number
b. Pump model number
c. Pump serial number
d. Size (including impeller diameter scheduled in inches)
e. Type
f. Equipment designation as listed on the pump schedule.
g. Flow scheduled (gallons per minute)
h. Dynamic head scheduled (feet of water)
i. Efficiency (percent)
j. Shut-off head (feet of water)
k. Speed (rpm)
l. Brake horsepower
m. Maximum brake horsepower with rated impeller
n. Rotation
o. Maximum allowable pressure (psig)

E. The schedule on the drawing sets forth the type of pump and GPM required.
1. The head capacities and horsepower are for bidding purposes only.
2. Make pump selection based on actual system calculations.

F. Acceptable manufacturers:
1. Armstrong Series 4300
2. Bell & Gossett
3. TACO with Sure-Flex Plus Elastomeric Couplings.

2.2 HORIZONTAL PUMPS

A. Pump Construction:
1. Cast iron, designed for 175 psi working pressure
2. Bronze case wear rings
3. Grease lubricated ball bearings selected for an average life of 200,000 hours; pressure grease fittings
4. Flexible coupled
5. Hot Dipped galvanized drip-rim structural steel base extending past the pump flanges allowing all condensation to be accumulated. Galvanized integral drain pan.
6. Coupling shall be high torque rated with EPDM and Neoprene construction by Sure-Flex
7. Falk all-metal center dropout spacer coupling
8. Totally enclosed metal or high-impact polyethylene plastic (Orange Peel) coupling guard per ANSI B15.1, Section 8 and OSHA 1910.219
9. Suction and discharge flange gauge ports
10. Fully enclosed bronze impeller keyed to the shaft
11. 304 Stainless steel shaft minimum

B. End suction pump volute with integrally cast pedestal support foot for back pullout to

allow pump to be serviced without disturbing the system piping. Pumps utilizing pedestal mounted bearing frames in lieu of volute will not be accepted.

C. Bearings:
   1. Conform to Anti-Friction Bearing Manufacturers Association (AFBMA) Standards
   2. Ball or roller bearing pillow block type
   3. Self-aligning
   4. AFBMA L50 rating of 200,000 hours

D. Horizontal or vertical split case pumps: Double row grease lubricated ball bearing each side.

E. Provide each pump with an internally flushed mechanical seal. If external flush line is required, provide sediment filter for each line.
   1. Use seal materials suitable for the pumped liquid
   2. Renewable bronze or stainless shaft sleeve

F. Provide each pump with a stuffing box with packing:
   1. Hardened 440C stainless steel renewable shaft sleeve
   2. Bronze gland and stainless steel gland bolts
   3. Oil graphite packing

G. Paint entire unit with two coats of machinery enamel after completion of installation.

H. Pump Motor:
   1. Premium efficiency
   2. Totally enclosed fan cooled
   3. Cast iron frame and end plate
   4. Forge steel lifting eye
   5. Over sized conduit box with ground lug
   6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve
   7. Designed for Variable Frequency Drive Application
   8. Provide with factory installed shaft grounding rings by AEGIS.
   9. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

I. Data plates:
   1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
   2. Locate the nameplate for easy visibility.
   3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
      a. Manufacturer, address, telephone number
      b. Pump model number
      c. Pump serial number
      d. Size (including impeller diameter scheduled in inches)
      e. Type

f. Equipment designation as listed on the pump schedule.
g. Flow scheduled (gallons per minute)
h. Dynamic head scheduled (feet of water)
i. Efficiency (percent)
j. Shut-off head (feet of water)
k. Speed (rpm)
l. Brake horsepower
m. Maximum brake horsepower with rated impeller
n. Rotation
o. Maximum allowable pressure (psig)

J. The schedule on the drawing sets forth the type of pump and GPM required.
1. The head capacities and horsepower are for bidding purposes only.
2. Make pump selection based on actual system calculations.

K. Acceptable manufacturers:
1. Armstrong
2. Bell & Gossett
3. TACO with Sure-Flex Plus Elastomeric Couplings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
1. Provide access space around pumps for service.
2. Install pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Install stainless steel drain pan with trough under chilled water pumps only.
3. Provide air cock and drain connection piped to floor drain.
4. Lubricate pumps prior to start-up.
5. Install condenser water pumps to ensure a full flooded suction.
6. Paint entire unit with two coats of machinery enamel after completion of installation.
7. Provide a spool piece between the suction diffuser and the suction side of the pump minimum length 8" face to face.
8. Provide pressure taps with valves on each side of the pump.
9. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60” above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.

B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.

C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

D. Ensure pumps:
1. Operate at specified system fluid temperatures without vapor binding and cavitation.
2. Are non-overloading in parallel and individual operation.
3. Operate within 25 percent of midpoint of published maximum efficiency curve.

E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be

submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.

1. Technicians, as required, shall be trained and experienced in the work they perform (contractor start-up / alignment is unacceptable).

B. Before starting pumps, but after connecting piping:

1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
3. Submit readings for approval.
4. Include the approved readings in the Owner's Maintenance Manual.

3.3 FINAL PUMP FLOW CALIBRATION

A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:

1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.

B. Enter the information on the final configuration of the pump in the Owner's Manual.

1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.4 SPARE PARTS

A. Provide the following spare parts and material to the Owner for his use after the warranty period.

1. A mechanical seal for each pump
2. A set of bearings for each pump

3.5 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:

1. Unit identification as indicated on Contract Drawings.
2. Equipment served by unit
3. Serial Number.
4. Model Number.
5. GPM and FT. HD.
6. Motor HP.
7. Sales Order #.
8. Date unit manufactured.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Pipe and Pipe Fittings
   2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.

B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.

B. Use valves with a bronze body and sweat-type connections.

C. Provide stainless steel stem and plunger assembly and a stainless steel piston.

D. Furnish sealed and moisture proof solenoid coils.

E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

A. Furnish replaceable core liquid line filter dryer.

B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 - EXECUTION

3.1 BRAZING

A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.2 PRESSURE TEST

A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
   1. Test joints with a Halide torch or an electronic leak detector.
   2. Repair leaks and retest each system until proved tight.

3.3 EVACUATION AND DRYING

A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.

1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.4 PIPE SIZE

A. Pipe shall be routed and sized per condensing unit manufacturer's instructions.

3.5 MINIMUM HEIGHT

A. Exposed refrigerant piping installed in open spaces shall be installed 7'-3" or higher above finished floor.

3.6 REFRIGERANT PIPE ENCLOSURE

A. Refrigerant piping shall be protected by locating it within building elements when routed below 7'-3" above finished floor except where located within 6'-0" of the refrigerant unit.

3.7 PIPE IDENTIFICATION

A. Pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation.

B. The minimum height of the lettering of the identification label shall be ½".

C. The identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For group A2, A3, B2, B3 refrigerants, the identification shall also include the following statement: "DANGER – Risk of Fire or Explosion." For any group B refrigerant, the identification shall also include the following statement: "DANGER – Toxic Refrigerant."

3.8 REFRIGERANT PIPE PROTECTION

A. Where A2L and B2L refrigerant piping is located in concealed locations where the pipe is installed in studs, joists, rafters, or similar member spaces and located less than 1.5" from the nearest edge of the member, a shield plate shall be installed for continuous protection. Protective steel shield plates having a minimum of 16 gauge shall cover the area of the pipe plus the area extending 2" or more beyond both sides of the pipe.

B. Refrigerant piping shall be installed as to prevent strains and stresses that exceed the structural strength of the pipe. Pipe must be protected from damaging resulting from vibration, expansion, contraction, and structural settlement

3.9 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.10 STOP VALVES

A. Stop valves shall be installed on the suction inlet and discharge outlet of each compressor or condensing unit and outlet of each liquid receiver for systems containing more than 6.6 lbs of refrigerant.

B. In addition to part A. above, stop valves are also required on the inlet of each liquid receiver and inlet of each condenser where more than one condenser is used in parallel for systems containing more than 100 lbs of refrigerant.

C. Stop valves shall be identified where their intended purpose is not obvious.

END OF SECTION

SECTION 23 2513
CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide equipment, chemicals and treatment materials for the complete water treatment system.

B. Determine which chemicals to use from the results of a water sample analysis taken from the building domestic water supply.

C. Provide water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for each system specified.

1. Closed chilled and hot water systems
2. The cooling tower condenser water system
3. Closed condenser water system

1.2 SERVICE AND SUPPLIES

A. All work shall be performed by a qualified, full-time, Water Program Manager.

1. Specialist in the field of industrial water treatment.
2. Facilities include water analysis laboratory, development facilities and service department.

B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride) for field use including test equipment and reagents as required for specific use with the treatment products employed.

C. Where specialized supplementary testing or control equipment is required, provide appropriate items.

D. Provide a water management and service program for a period of one year beginning at substantial completion. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.

E. Routing Services

1. Check and adjust water treatment system operation.
2. Instruct, train and advise operating personnel.
3. Check efficiency of chemicals and chemical applications.
4. Replenish chemicals and replace expendables.
5. Clean or replace filter in feeder.

F. Chemically clean the piping system.

G. Provide a complete laboratory analysis of water samples. Insert in the Owner's manuals.

H. Provide review of report figures in the field water testing.

1.3 QUALITY ASSURANCE

A. Acceptable program manager shall have:

1. Research and development facilities.
2. Regional laboratories capable of making water analysis.
3. A service department and qualified technical service representatives located within a reasonable distance of the project site.
4. Service representatives who are registered Engineers or factory-certified technicians with not less than 5 years of water treatment experience with the water treatment system manufacturer.

B. Ensure that all products, packaging, blow-down or other effluents do not violate local, state, or federal laws or regulations. Use only chemicals that are registered, when required, with the U.S. Department of Agriculture or the U.S. Environmental Protection Agency and that are labeled as required by law.

C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chem Aqua

2.2 CLOSED CHILLED AND HOT WATER SYSTEM

A. By-pass filter feeders in the hot water and chilled water systems:
   1. Rated at 40-gpm capacity.
   2. Operating conditions: 150 psig and 250°F.
   3. Quick opening cap with a Buna N-O ring seal; or 1-1/2" valve and funnel.
   4. 5 micron polypropylene filter bag mounted in a perforated stainless steel holder. Filter bag shall be supported from top of feeder.
      a. Filter bag and holder shall extend full length of feeder tank.
      b. Bottom feed tanks are not acceptable.
   5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
   6. Provide sufficient quantity of filter bags for warranty period. Minimum of six additional bags provided to owner.

B. Acceptable Manufacturers
   1. Neptune Model FTS-5
   2. Efficiency Dynamics FF-100.
   3. J.L. Wingert Model FHC-5HD.
   4. Hydro-systems HS-800
   5. Vector Industries, Inc. FA-900

C. Treatment chemicals:
   1. Furnished as a concentrated liquid in 5 gallon pails
   2. A corrosion inhibitor of the nitrite-borate type.
   3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500 in hot loops.
   4. With effective copper, black iron, stainless steel and aluminum corrosion inhibitors.
   5. Form a protective film to prevent corrosion and scale formation.
   6. Have colored dye to indicate presence.

D. Multiple chemicals used in a common system shall be compatible.

E. Flow Indicator:
   1. Bronze Construction
   2. Rotating Wheel
   3. Line Size
   4. Double Window
   5. Ernst Flow Industries Model EFIE-57-3

PART 3 - EXECUTION

3.1 INSTALLATION/START-UP

A. In accordance with manufacturer's recommendations.

B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.

C. Clean and flush closed loops systems.
   1. Clear water flush systems before introducing chemical cleaners.
   2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.
   3. Chemical Cleaner shall passivate and pre-film pipe system.

3.2 WATER ANALYSIS

A. The chemical treatment agency shall provide the services of a testing laboratory to

perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.

1. Silica in water and wastewater.
2. Acidity or alkalinity of water.
3. Iron in water.
4. Hardness of water.
5. Ph of water.
6. Particulate and Dissolved Matter, Solids or Residue in Water.
7. Turbidity in water.
8. Corrosivity of water in absence of heat transfer.
9. Standard practices for sampling water.

B. Take water samples in accordance with ASTM.

C. Prepare a test report in accordance with ASTM for each of the tests conducted.

D. Submit the test reports to the Architect/Engineer.

3.3 CHEMICAL TREATMENT

A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:

1. Chilled water.
2. Hot water.
3. Condenser water.

B. The chemical treatment agency shall provide, but not be limited to the following:

1. Equipment and installation.
2. Chemicals.
3. Analytical and testing work.
4. Inspection.
5. Calculations.
6. Assistance to the trade installing the piping.
7. Instruction to Owner.

C. Determine which chemicals to use from the results of site water analysis. Provide the chemical necessary to achieve the desired water condition.

D. Examine and supervise flushing and pipe cleaning operations and verify that the systems are clean, free of debris and rust and other construction materials before starting water treatment.

E. After the piping has been flushed, cleaned, rinsed and charged with chemicals, then start-up and operate the chemical treatment equipment to provide steady, stable characteristics for the systems treated.

F. During construction, instruct the Contractor in the field piping and wiring of chemical feeding equipment. If such piping and wiring details are not shown on the Contract Drawings, then provide all equipment, piping, wiring, instrumentation and chemicals to provide a complete and operating system without additional cost.

G. After the chemical treatment is functioning as intended, the chemical treatment agency shall demonstrate to the Architect/Engineer the chemical treatment operation.

3.4 OWNER TRAINING

A. A chemical treatment agency, in conjunction with the chemical treatment equipment manufacturer’s factory representative, shall train the Owner to operate and maintain the chemical treatment system as a whole and in part for each piece of equipment.

B. Furnish to the Owner a chemical treatment administration manual covering the chemical treatment program for each of the systems treated. The manual shall include, but not be limited to:

1. Name, address and telephone number of the chemical treatment agency and each of the equipment manufacturers.
2. Operation and maintenance manuals.
3. Test reports.

4. Chemical data sheets.
5. A narrative describing the chemical treatment program for each of the systems being treated.

3.5 TESTING AND INSPECTION

A. After the systems have been accepted, the chemical treatment agency shall visit the site every month during the warranty period.

B. During each visit:
1. Check and adjust the chemical treatment equipment.
2. Check the chemistry of the treated system to confirm the chemicals are maintaining the system as intended.
3. Advise and instruct the Owner on operational changes made to the chemical treatment program.
4. Take a water sample of each system being chemically treated and have the samples tested by a testing laboratory. Prepare a report for each water sample and submit it to the Owner. Include in the test report the changes that need to be made to the chemical treatment program.
5. Maintain complete records of the treatment program for each system at the project site. Keep the records in a hardbound manual with the building manager. A second copy shall be maintained by the agency for the agency's records.

C. Routine visits must be coordinated with the Owner.

D. Send copy of monthly report to Engineer for Verification.

END OF SECTION

SECTION 23 3113
DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Devices
   2. Air Handling Units
   3. Insulation
   4. Terminal Units
   5 Fan Coil Units
   6. Fans
   7. Packaged Rooftop Air Conditioners
   8. Testing, Balancing and Adjusting (TAB) of Environmental Systems

B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.

B. An approved contractor for this work under this division shall be:
   1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
   2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.

B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and summit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.

B. Submit product data and sealing materials to be used.

C. Submit sound attenuation data.

D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.

B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.

C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
   1. Galvanized

D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.

2.3 ACOUSTICAL DUCT

A. Duct and fittings:
   1. Double wall acoustically treated.
   2. Annular space packed with fiberglass insulation.
   3. Perforated metal liner to provide specific acoustic impedance
   4. Insulation 1.0 pcf. 1 inch thick
   5. United McGill Acousti-K27 spiral lockseam or approved equal
   6. Material as indicated below:
      a. Paintable Galvanized Steel

2.4 DUCT SEALING OF SEAMS AND JOINTS

A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
   1. Indoor applications – Foster 32-14
   2. Outdoor applications – Foster 32-17

2.5 FLEXIBLE DUCT LOW PRESSURE

A. Construction:
   1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
      a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
   2. UL 181 Class I air duct label
   3. Reinforced vapor barrier jacket
   4. Rated for use at system pressure (6" wc minimum)
   5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.

B. Fire hazard classification:
   1. Flame spread rating 25 maximum.
   2. Smoke developed rating 50 maximum.

C. Thermal characteristics:
   1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)

2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
3. 2" minimum wall thickness insulation with 1" overlap

D. Acceptable manufacturers:
1. Flexmaster
2. Hart & Cooley
3. Omniair
4. Peppertree Air Solutions

2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.

B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
Positive: 12" w.g.
Negative: 5" w.g.

C. The duct shall be rated for a velocity of at least 5500 fpm.

D. Suitable for operating temperature range of -20°F to +250°F.

E. Factory insulate the flexible duct with fiberglass insulation.
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
3. 2" minimum wall thickness insulation with 1" overlap

F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.

G. Acceptable manufacturers:
1. Flexmaster
2. Omniair
3. Peppertree Air Solutions

2.7 FIRE DAMPERS

A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.

B. Acceptable Manufacturers:
1. Ruskin
2. Prefco Products
3. Air Balance
4. Greenheck, Inc.
5. Nailor Industries
6. Pottoroff

2.8 CEILING RADIATION DAMPERS

A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.

B. Acceptable Manufactures
   1. Ruskin
   2. Prefco
   3. Air Balance
   4. Phillips
   5. Safe-Air
   6. Nailor Industries

2.9 WALL LOUVERS

A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
D. Acceptable manufacturers:
   1. American Warming and Ventilation
   2. Arrow
   3. Greenheck
   4. NCA
   5. Pottorff
   6. Ruskin

2.10 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

2.11 FLUE CAPS

A. Stainless steel flue caps of a design so that wind action from any direction will create a vacuum in the flue. Caps as manufactured by Breidert or equal are acceptable. Refer to installation details on drawings.

2.12 DUCT LINING

A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.13 VOLUME DAMPERS

A. Manual balancing dampers that meet or exceed the following minimum construction standards:
   1. Frame 16-gauge
   2. Blades 16-gauge
   3. Bearings corrosion resistant
   4. Concealed linkage
   5. Opposed blade dampers
B. Acceptable manufacturer:
   1. Ruskin Model MD-35 or approved equal, by
   2. Arrow
   3. American Warming and Ventilating
   4. Nailor Industries

5. Pottoroff

2.14 ACCESS DOORS

A. Round spin-in door of galvanized steel.
   1. Fire proof sealing gaskets and quick fastening locking devices
   2. Insulated door
   3. Conform to the requirements of the NFPA
   4. Identification and use of each access door
   5. UL label to match the construction in which it is installed
   6. Cable attached to door and outer frame
   7. Low leakage Access Door

B. Acceptable Manufacturer
   1. Flex master, Inspector Series
   2. Approved Equal

2.15 COMBINATION FIRE/SMOKE DAMPERS

A. Combination fire/smoke dampers meeting the following requirements:
   1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
   2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
   3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
   4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
   5. Provide UL555S qualified electric actuator at 120 VAC.
   6. Provide air-foil type blades.

B. Provide integral sleeves

C. Acceptable Manufacturers:
   1. Ruskin
   2. Air Balance, Inc.
   3. Greenheck, Inc.
   4. Nailor Industries

5. Pottoroff

2.16 SMOKE DAMPERS

A. Smoke dampers meeting the following requirements.
   1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
   2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
   3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
   4. Provide UL555S qualified electric actuator at 120 VAC.
   5. Provide air-foil type blades.

B. Provide integral sleeves.

C. Acceptable Manufacturers:
   1. Ruskin
   2. Air Balance, Inc.
   3. Greenheck, Inc.
   4. Nailor Industries
   5. Pottoroff

2.17 DIFFUSER FITTINGS LOW PRESSURE TAPS

A. Fitting shall meet or exceed the following minimum construction standards:
   1. Conical with a base diameter two inches larger than the tap diameter.
   2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
      a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
      b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
      c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
   3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
      a. Through 8 inches: 26 gauge; Damper blade 22 gauge
      b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
      c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
      d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
   4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
   5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
   6. Provide the damper with a self-locking regulator and handle.
   7. Provide a 2” sheet metal stand-off to extend the regulator.

8. Flex duct grip area – 2 inches behind retaining bead
9. Flex duct retaining bead – 1 inch from end
10. Conical length of at least 3 inches
11. Barrel length of at least 9 inches

2.18 AUXILIARY DRAIN PANS

A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

2.19 DUCTWORK SUPPORTS ON ROOF

A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable height and width. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized framing. Nuts and washers shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
I. Install end bearing at all location where damper shaft penetrates duct wall.
J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.

D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
   1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
   2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.

E. Use pushrod operator with locking nut and butt hinges assembly.

F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
   1. Return air ductwork
   2. Outside air branch duct
   3. Exhaust branch duct
   4. Exhaust connections to hoods except kitchen grease hoods or equipment
   5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
   6. At each outside air and return air duct connection to plenum of constant volume units
   7. At discharge side of constant volume boxes
   8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
   9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.

G. Elbows:
   1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
   2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.

H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.

I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

J. Insulated Flexible Duct:
   1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
   2. Construct bends over 45° with sheet metal elbows.

K. Duct Supports:
   1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means

of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.

2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, “Everdur” welded and coated with “Galvabar”.

3.3 PLENUMS

A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
B. Fabricate plenums upstream of fan of 16-gauge material.
C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
   1. Fire Dampers
   2. Smoke Dampers
   3. Smoke/fire Dampers
   4. Outside Air Dampers
   5. Duct Mounted Coils (up-stream)
   6. Control Dampers
B. Size access door 1" smaller than ductwork.
   1. Available Sizes: 8”, 10”, 12”, 18”, 24”
C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from

the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.

C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.

D. Do not install liner in multi-zone unit ductwork.

3.7 SEALING OF SEAMS AND JOINTS

A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

A. Provide and install flues for all gas fired equipment.

B. Refer to plans for all related locations.

C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.

D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.

E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 DISHWASHER HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

3.10 SHOWER AREA EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

3.11 KITCHEN EXHAUST DUCT

A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.12 FUME HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 stainless steel construction.

3.13 ACOUSTICAL DUCT

A. Install in the following locations:

1. Where indicated on the drawings

3.14 SCREENS

A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2”) mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.15 CONNECTIONS TO LOUVERS

A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.

B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.16 PLENUMS

A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross broken and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.

B. Provide access doors.

3.17 AUXILIARY DRAIN PANS

A. Where coils that have a condensate drain are located above ceiling.

3.18 TESTING OF LOW PRESSURE DUCTWORK

A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.

D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

A. As the project progresses, test the ductwork in sections.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Finally as a complete system, test ductwork at a minimum of 2.5” with a maximum allowable leakage of 1% of the total design supply airflow.

D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

SECTION 23 3114
FABRIC AIR DISPERSION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

1.2 QUALITY ASSURANCE

A. Building Codes and Standards:
   1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of MFPA 90-A and are also classified in accordance with ICC Evaluation Service AC 167.
   2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
   3. Product must be treated with an EPA registered antimicrobial agent.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and ICC AC167.
C. Submit manufacturer's documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Submit parameters for design, including maximum air temperature, velocity, pressure and fabric permeability.
D. Color selections
E. Manufacturer's recommended suspension system

1.4 WARRANTY

A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect fabric air dispersion systems from damage during shipping, storage and handling.
B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 -PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, choose one of the following:
A. DuctSox Corporation
B. Fabric-Air
C. KE Fibertec
D. Prihoda

2.2 FABRIC AIR DISPERSION SYSTEM

A. Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:
   1. Fabric Construction: 100% Flame Retardant and treated with a machine wash-able anti-microbial agent from the manufacturer.
   2. Weight: 6.75 oz./yd^2 per ASTM D3776
   3. Fabric Porosity: 1.5 (+2/-1) cfm/ft^2 per ASTM D737, Frazier
   4. Temperature Range: 0 degrees F to 180 degrees F
   5. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90-A and ICC AC 167.

6. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.

B. Systems Fabrication Requirements:
1. Air dispersion and extended throws accomplished by reinforced orifices and permeable fabric. Reinforced orifices are to be installed to deep the integrity of opening and withstand laundry processes.
2. Diameter, quantity, and location of reinforced orifices to be specified and approved by manufacturer.
3. 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.
4. Inlet connection includes zipper for easy removal/maintenance.
5. Lengths to include required zippers as specified by manufacturer.
6. System to include adjustable flow devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Fabric system shall include connectors to accommodate suspension system listed below.
9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows to be 5 gores with the radius of the elbow 1.5 times the diameter.

C. Systems Design Parameters:
1. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.
2. Do not use fabric diffusers in concealed locations.
3. Fabric diffusers shall be designed from 0.25” water gauge minimum to 3.0” maximum, with 0.5” as the standard.
4. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
5. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.

D. Fabric Tensioning System:
1. Air diffusers shall be constructed with internal tensioning frame.
2. System shall cylindrically tension textile along the entire length of textile duct.
3. Tensioning system shall include full 360 degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system.
4. Interior structure to include multiple mechanically adjustable tension devices. To provide proper textile tensioning, structural and textile system shall be configured in segments of no more than 45 feet.
5. Textile components supported solely by metal cylindrical rings.
6. Each cylindrical ring shall require vertical metal to metal vertical cable safety attachment.
7. Component options include:
   a. Stainless Steel Cable
   b. Adjustable Gripple Mid-Supports – incremental lengths of 5’, 10’, 15’, 20’ and 30’

D. Suspension Hardware:
1. 3x1 Suspension or Internal Hoop Suspension (for duct diameters 10” to 48”): As a minimum, the system shall include a 3 row connection to fabric system at 10, 12, and 2 o’clock locations. The powder-coated aluminum hangers are secured and connected to a single (1 row) tension cable every 3’-0” and connect to the fabric system at the 10 and 2 o’clock locations with detachable D-Clasps. The fabric system will also have intermediate cable clips located at 12 o’clock and between the hangers to attach directly to the single tension cable system located

3” above top-dead-center location of the fabric system. Tension cable hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckles as required.

2. Component options include:
   a. Stainless steel cable
   b. Adjustable Gripple Mid-Supports – incremental lengths of 5’, 10’, 15’, 20’ and 30’.

PART 3 - INSTALLATION

3.1 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM

A. Install approved suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION

A. Clean air handling unit and ductwork prior to installation of the fabric duct system. 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 duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

SECTION 23 3416
FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

A. Division 23 Mechanical:
   1. Ductwork
   2. Vibration Isolation
   3. Air Balance
   4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.

B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.

C. Statically and dynamically balance all fans.

D. Motors shall be sized so that they do not operate within the motor service factor.

E. Fans shall be capable of 120% of the scheduled air capacities.

F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

A. Submit fan performance curves with system operating point plotted on curves.

B. Submit manufacturer’s printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cook

B. Greenheck

C. Penn Barry Ventilator

D. Twin City Fans

2.2 PROTECTIVE COATINGS

A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.

B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.

B. Belt Drives:
   1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable

pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.

2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
3. Provide belt guards and apply the same finish as used on the fan.
4. Oil and heat resistant, nonstatic type belts.
5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.

C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.

D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.

E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.

F. Where motorized damper is scheduled:
1. The motor and damper are specified in the Building Management and Control System Specification.

G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
1. Fan mark as indicated on the Contract Drawings.
2. Serial number
3. Model number
4. Capacity (CFM) and static pressure.
5. Motor HP
6. Motor Amps
7. Manufacturer
8. Motor phase
9. Number of Belts/Make/Size
10. Motor volts

2.4 VENTILATION AND EXHAUST FANS

A. Provide the ventilation and exhaust fans shown on the drawings.

B. Provide each motor with internal overload protection.

C. Provide each belt driven fan with approved, totally enclosed belt guard.

D. Provide approved safety screen where inlet or outlet is exposed.

E. Provide duct flanges where required for connections.

F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.

G. Furnish supply fans with 1” aluminum, washable filter section.

2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

A. Provide the rooftop ventilation and exhaust systems shown on the drawings.

B. Provide each motor with internal overload protection.

C. Components:
1. Aluminum, stainless steel or plastic coated bird guard.
2. Screws and fasteners of stainless steel or nonferrous material.
3. All aluminum construction unless indicated otherwise on fan schedule.

D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.
E. Aluminum base shall be continuously welded curb cap corners.

2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

A. Provide the rooftop intake and relief vent systems shown on the drawings.
B. Provide with aluminum, stainless steel or plastic coated bird guard.
   1. Screws and fasteners of stainless steel or nonferrous material
   2. All aluminum construction
C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
D. Aluminum base shall be continuously welded curb cap corners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.
B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer’s installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1” x ¼” gasket. Gasket shall be glued or attached with pressure sensitive adhesive.
D. Install curbs and equipment in level position.
E. Ceiling mounted in-line centrifugal blowers
   1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
   2. Provide sub-structure where required.
   3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23 3616
VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
   1. Provide constant fan variable volume terminal units where indicated on the drawings.
   2. Provide variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.
   4. Building Management and Control System.
   5. Vibration Isolation,

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.

B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.

C. Submit for each box the following information:
   1. Box size
   2. Inlet size
   3. Box number
   4. Box designation
   5. Minimum / Maximum Fan CFM
   6. L / R Coil connection
   7. GPM
   8. Motor HP
   9. NC Level
   10. External Static Pressure
   11. Scheduled MBH
   12. Actual MBH
   13. Heating Coil Pressure Drop (ft.)
   14. Entering and Leaving Water Temperature
   15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE.

A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.

B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.

C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Titus.
B. Krueger
C. Price
D. Nailor
E. Metalaire

2.2 BOX CONSTRUCTION

A. Galvanized 20 gauge steel casing with suspension lugs.
B. Lined with minimum 1.5 PCF / 1" thick fiber free
   1. Flame spread not higher than 25.
   2. Smoke developed rating not higher than 50.
   3. Condensation on the exterior of the box is not approved.
   4. Coat all cut edges of liner with NFPA approved sealant.
   5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
D. Components shall be constructed of corrosion resistant materials.
E. Bearings shall not require lubrication.
F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0” WG interior casing pressure.
G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
H. The maximum overall height of the variable air volume unit shall not exceed available ceiling space.
I. Maximum static pressure drop of air through terminal box shall be 0.2” w.g.
J. Maximum velocity through duct inlet shall be 2,000 fpm.

2.3 COMPONENTS

A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.
B. Provide each unit with a primary variable air volume damper that controls the air quantity in response to a space sensor.
C. Each unit shall contain:
   1. Fan and motor assembly. For Fan Powered Units Only
   2. Heating coil.
D. Locate the heating coil in the discharge of the blower section.
E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or ETL Certified, electrical components shall be UL listed and installed in accordance with the National Electrical Code.
F. The variable air volume units provided by the manufacturer shall be the quietest design available from the manufacturer for the type specified.
G. Induced air filter frame for 1” thick disposable filter.
H. Sufficient power for the VAV unit DDC controller, electric actuator and other components necessary to satisfy the sequence of operation. Size each transformer for the total connected load plus an additional 25% of the connected load. Primary and secondary fuses housed in a fuse block.
I. Inlet attenuator for induction airside of box with liner to lower radiated noise.

2.4 BLOWER FAN AND MOTOR

A. Blower fan:
   1. Constructed of steel.
   2. Forward curved centrifugal wheel.

3. Dynamically balanced wheels.
4. Direct drive motors.

B. Motor
1. Ultra-high efficiency ECM motor technology

C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify voltage with Electrical Plans.
1. Thermal overload protection.
2. Sleeve bearings.

D. Provide isolation between fan motor assembly and unit casing.

E. Provide a manual speed control system to allow continuously adjustable fan speed from maximum to minimum.
1. Electronic speed control matched to operate with the motor.
2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot operate in a stall mode.

F. Fan disconnect switch. This is not to be used as a main disconnect switch.

G. Provide electric heating models with the following items:
1. Single point electrical connection
2. Line side disconnect switch
3. Motor fuse
4. Motor disconnect switch
5. Fan SCR and relay
6. Control transformer
7. Air flow switch
8. Heat contactors
9. Thermal Hi-Limit Auto Reset switch

2.5 PRIMARY AIR DAMPER AND ACTUATOR

A. The control actuator shall vary the primary air damper in response to the control signal.
1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
2. Locate the damper inside the unit.
3. Damper connection to the operating shaft shall be a positive mechanical connection.
4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.
7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.

2.6 AIR FLOW CONTROL

A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
1. Air quantity shall be factory set.
2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
3. Control shall be pressure independent.
4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.

5. Provide flow measuring taps and a flow chart with each unit for field balancing air flow.

B. HOT WATER HEATING COILS
1. Provide hot water heating coils sized as scheduled.
a. The hot water heating coil is specified to be provided and mounted under the work of this Section.
b. Coil access door upstream of coil.
c. Install coil with supply inlet at bottom and on leaving airside of coil.
d. Maximum static pressure drop of water through heating coil shall not exceed 10’ w.g.
e. Maximum static pressure drop of air through heating coil shall not exceed 0.25” esp

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
B. Install each unit in accordance with the manufacturer's printed installation instructions.
C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
1. Provide sub-structure where required.
2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
3. Install units so that they are level and plumb.
D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.
G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
H. All installation shall be in accordance with manufacturer’s published recommendations.
I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 30 inches from all obstructions (walls, pipe, etc.).
J. Provide ceiling access doors or locate units above easily removable ceiling components.
K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit’s hanger brackets and threaded rods.

3.2 MISCELLANEOUS CONTROLS

A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
1. Automatic temperature control card (DDC).
2. Damper actuator.
B. The following equipment items are to be furnished and installed by the Fan Powered Terminal Unit manufacturer:
1. Damper.
2. Multi-point flow sensor.
3. Controller enclosure.

4. Power transformer.

C. Coordinate the output voltage required by the Building Management and Control System.

D. Coordinate location of controller enclosure.

3.3 ACOUSTICAL PERFORMANCE TEST

A. Test each size for each type of variable air volume unit furnished on the project.

B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.

C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.

D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.

E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.

F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.

G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

1. Sound power levels are referenced to 10-12 watts.
2. Box inlet static pressure = 1-1/2”
3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.

H. All terminal boxes shall be equipped with a sheetmetal elbow with liner connected to plenum air inlet.

3.4 SPARE PARTS

A. Provide one spare motor for each size box.

3.5 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, plastic laminated identification plate, permanently mounted with the following information:

1. Unit identification as indicated on Contract Drawings.
2. Area served by unit
3. Serial Number.
4. Model Number.
5. Capacity (CFM) and static pressure.
6. Motor HP.
7. Unit power supply: Volts / PH / Amps.
8. Coil GPM and pressure drop.
9. Sales Order #.
10. Date unit manufactured.

END OF SECTION

SECTION 23 3713
AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.

B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

A. Titus.
B. Krueger.
C. Nailor Industries.
D. Price
E. Metal-Aire

2.3 ACCESSORIES

A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct. Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.

B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
   1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
   2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION

SECTION 23 4100
AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air filters and air filter gauges.

1.2 RELATED WORK

A. Division 23 Mechanical.

1.3 SUBMITTALS

A. Submit manufacturer's product data sheets and capacity information as specified.
B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

A. The filter cells:
   1. Pleated media.
   2. Disposable type.
   3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
   4. 16 pleats per linear foot of filter.
   5. 2" thick.
   6. MERV 13
B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
   1. Seal the media pack in a chipboard frame.
C. Rated average dust spot efficiency of not less than 36%.
   1. Average synthetic arrestance in excess of 93% when tested in accordance with the ASHRAE 52-68 test standard.
D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.
E. Initial resistance to air flow:
   1. 300 fpm - 0.12" WG.
   2. 500 fpm - 0.28" WG.
F. UL listed with Class II rating.
G. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the filters and filter gauges in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 4300
AIR PURIFICATION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install an air purification system intended for the use as a part of another manufacturer's air handling unit as shown on the drawings, details and equipment schedules.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.
   4. Building Management and Control System.
   5. Ductwork.

1.3 REFERENCES

A. ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality
B. ASHRAE Standard 52.2 – Method of Testing General Air Cleaning Devices for Removal Efficiency by Particle Size
C. NFPA 70 – National Electrical Code
D. U.L. 867 – Electrostatic Air Cleaners
E. U.L. 2998 - Environmental Claim Validation Procedure (ECVP)

1.4 SUBMITTALS

A. Submit manufacturer's documentation in accordance with specification requirements.
B. Submit the following information:
   1. Manufacturer's installation instructions.
   2. Minimum Circuit Ampacity.
   3. Maximum Overcurrent Protection size.
   4. Electrical interlocks.
C. Submit recommended clearance dimensions for air flow and service.
D. Submit a schedule, at the front of the submittal, of equipment indicating:
   1. Unit designation
   2. Model number
   3. Electrical characteristics
E. Submit Copy of U.L. 2998 and U.L. 867 certificates for each product being submitted.
F. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.5 QUALITY ASSURANCE.

A. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
B. Manufacturers shall have their product tested to UL 2998 Environmental Standard for confirmation of no ozone with certificate available. The final report shall indicate the ozone levels and high voltage output the device's electrode(s) were operating during the test. Reports that do not include high voltage output during the UL 2998 testing shall not be acceptable.

1.6 DELIEVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.
B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

A. The manufacturer shall provide a parts warranty for a period of three (3) years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Global Plasma Solutions

B. Engineer and Owner approved equal. Must submit prior approval request to Engineer and Owner as described in specifications.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Each piece of air handling equipment (Air Handling Units, Outside Air Handling Units, Fan Coil Units, and Packaged Rooftop Air Conditioners), as designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.
5. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth. A non-contact voltage detector can confirm the entire coil is covered with airflow turned off. Devices that do not clean the entire coil are not acceptable.
6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
   a. MRSA - >96% in 30 minutes or less
   b. E.coli - > 99% in 15 minutes or less
   c. TB - > 69% in 60 minutes or less
   d. C. diff - >86% in 30 minutes or less
   e. Noro Virus -> 93.5% in 30 minutes or less
   f. Legionella -> 99.7% in 30 minutes or less
   g. SARS-COV2 -> 99.4% in 30 minutes or less
7. Capable of modular field assembly in six-inch (150mm) sections.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Ionizers with positive and negative output (DC type) shall be self-cleaning. Ionizers provided on AHUs shall be AC type ionizers with each electrode pulsing between positive and negative and the electrode shall be modular. Ionizers on RTUs shall be self-cleaning DC type ionization. All ionization systems shall use carbon fiber brushes

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

E. Equipment Requirements for Air Handling Units and Packaged Rooftop Air Conditioners:

1. Electrode Specifications (Bi-polar Ionization):

a. Each alternating current (AC) Ionization Bar with Bi-polar Ionization output shall include a minimum of eighteen carbon fiber cluster ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 0.50" (12.5mm) apart shall not be acceptable. The plasma electrode shall require no more than 1.0" (25mm) in the direction of airflow for mounting. AC ionization bars using any electrode material other than carbon fiber brushes, shall not be acceptable. All hardware required for mounting shall be provided by the air purification manufacturer except self-tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion.

b. Electrodes shall be provided in 6.0" (150mm) increments, epoxy filled for an IP55 rating and utilizing brass connection hardware that is recessed into the connection joint once fully engaged and assembled.

c. Electrodes shall be energized when the main unit disconnect is turned on.

d. The ionization output shall be a minimum of 140M ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles. Provide multiple rows of bars to achieve equivalent output per inch listed above.

e. Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.

f. Ionization bars shall be constructed of UL 94VO and UL746C composite material.

g. Device shall be OSPD certified.

F. Equipment Requirements for Ductless Units, Fan Coils and Wall Mount Units:

1. Electrode Specifications (Bi-polar Ionization):

a. The mechanical contractor shall mount the Plasma Generator and wire it to the unit control power (24VAC) as instructed by the Air Purification Manufacturer's instructions or line voltage subject to power available. Each unit shall be designed with a molded casing, programmable self-cleaning system, self-cleaning test button, power status LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per air handler is required to interface to the BAS or the optional DDC controller where airflow capacity requires more than one unit. Dry contacts proving power has been applied in lieu of the ion output is actually operating, are not acceptable. Manufacturers providing multiple ion modules that have alarm status wired in parallel, and not in series, shall not be acceptable.

b. Ionization output from self-cleaning units shall be a minimum of 200M ions/cc for units < 1200CFM and a minimum of 400M ions.cc for units > 1200CFM.

c. Carbon fiber brushes shall be replaceable.

d. Voltage input shall be universal acceptance from 24VAC to 240VAC or DC without the use of an external transformer.

G. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC, 115 VAC or 208-230VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

2. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset. Systems requiring fuses shall not be acceptable.

3. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS as well as a local “Plasma On” indication light.
4. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.
5. All wiring provided with plasma generator shall be plenum rated and have visible label on each wire routed in a return air plenum.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the substantial completion.

3.2 ASSEMBLY & ERECTION

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.
B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.
C. All equipment shall be protected from dust and damage on a daily basis throughout construction.
D. Units equipped with dry contacts for BMCS interface shall NOT be utilized on this project.

3.3 INSTALLATION

A. For bar installations on any unit that will not allow for the use of provided magnets, contractor shall provide a Unistrut support system to ensure bars can be located and installed per manufacturers installation instructions and recommendations.
B. Power modules mounted on the exterior of interior Air Handling Units shall be installed at locations that avoid restricting Air Handling Unit functionality, component access, or conflict with service doors.
C. All Ionization unit wiring routed internally to air units shall be secured using cable hold down clips and routed neatly and, in a manner, to avoid physical damage or operation.

3.4 ASSEMBLY & ERECTION: PLASMA GENERATOR

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.
B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.
C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.5 TESTING

A. Provide the manufacturers recommended electrical tests.

3.6 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

SECTION 23 5235
GAS-FIRED MODULATING HOT WATER BOILER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies a packaged, gas-fired, power type condensing stainless steel boiler complete with all controls and trim for indoor installation.

B. 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.

C. 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.

1.2 RELATED WORK

A. Division 23 - Mechanical
   1. Hot Water Piping
   2. Gas Piping
   3. Ductwork

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings. Boiler shall be certified for up to 99% efficiency.

1.4 WARRANTIES

A. The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of eighteen (18) months from date of substantial completion. Heat exchanger and fuel burner shall be warranted for a period of five (5) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Laars MagnaTherm

B. Patterson Kelly Sonic

C. RBI Flexcore

2.2 PERFORMANCE CRITERIA

A. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 92 % on 500 MBH input boilers and less and not less than 95% on larger than 500 MBH input boilers. Each boiler shall be capable of operating with a minimum outlet water temperature of 68º F.

B. Boiler shall comply with ASME Section IV for 80 psig, max 200º F (100 psig on 1500 MBH and larger units).

C. 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 inch WC to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14 inch WC.

D. Boilers shall be certified for low NOx by the TCEQ. NOx emissions shall not exceed 30 PPM when referenced at 3% O2 at all firing rates.
E. The burner, gas train and controls shall conform to the requirements of I.R.I. /G.E. Gap.

2.3 BOILER DESIGN

A. Each hot water boiler shall consist of a horizontal, stainless steel 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.
B. Each boiler heat exchanger shall be stainless steel, 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.
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.
F. 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.
G. 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.
H. An observation port shall be located on the boiler to allow for observation of the burner flame.
I. Boiler shall have a single condensing heat exchanger. A boiler that utilizes a secondary condensing heat exchanger is unacceptable.

2.4 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 is 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.
    6. Separate inlet and outlet water temperature sensors capable of monitoring flow
    7. Exhaust temperature sensor
    8. Provide condensate neutralization kit (shipped loose).

2.5 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 operate at 6000 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 text based 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 Micro Processor 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 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. Text Based 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

2.6 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:
   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 inch 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

2.7 IGNITION SYSTEM

A. Each boiler shall be equipped for direct spark ignition

2.8 COMBUSTION AIR CONTROL SYSTEM

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 insure that combustion air is supplied.
3. High exhaust back pressure switch

2.9 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.

2.10 BOILER 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.
3. Control circuit breaker, 5 amp
4. All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.
5. Text Based Display Panel to adjust set points and control operating parameters. Text Based Display is 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.

2.11 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.

2.13 SEQUENCE CONTROLLER

A. Boiler shall be provided with a boiler sequence controller that is capable of controlling a) one or multiple boilers, b) all condensing or all non-condensing boilers, c) combination of condensing and non-condensing boilers (hybrid system). When controlling hybrid systems, sequence controller shall sequence the lead boiler based on its condensing capabilities to provide the most efficient operation. Controller shall be capable of communicating via MODBUS protocol. Controller shall allow boiler or boilers to operate off of a remote header sensor (header sensor provided by boiler manufacturer, installed by contractor). Controller

shall be capable of allowing boiler or boilers to operate based on outdoor reset, see specification Section 23 09 33 for reset schedule. This shall be achieved by either, a) programming the controller with an outdoor air reset curve in conjunction with a separate outdoor air sensor (outdoor sensor shall be provided by boiler manufacturer, installed by contractor), b) setpoint control via 0-10 VDC analog communication with building automation system, c) setpoint control via MODBUS communication. Controller shall visually display relay status, firing rate of each boiler, header temperature, outdoor air temperature. Coordinate wiring of this controller with mechanical and control's contractor.

2.14 CARBON MONOXIDE MONITORING SYSTEM

A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room when combustion air is ducted to boilers. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 100ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.

B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module.
   1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
   2. NEMA 1 Enclosure
   3. Complies with Texas State Boiler Code 65.603-2015
   4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
   5. Provide expansion board for additional equipment interlocks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolation valves and unions on supply and return water lines to boiler.

B. Install strainer, drain with valve, pressure and temperature gauge on return water line to boiler.

C. Install main gas cock, drip leg and union close to boiler.

D. Install on 4" concrete pad and place into operation in accordance with manufacturer's instructions. Pipe as detailed on drawings.

F. Provide Category IV vent stack material. Mechanical contractor shall coordinate draft requirements and other venting requirements between stack supplier and boiler supplier.

G. Install boilers, piping and accessories in accordance with the manufacturer's installation instructions and state boiler code.

H. Pipe each gas relief vent to the outdoors, in accordance with the manufacturer's recommendations and the local codes.

I. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

J. Contractor to route condensate connection off of boiler and stack to acid neutralization kit and then to appropriate drain. Trap as required by boiler manufacturer.

3.2 BOILER MANUFACTURER STARTUP SERVICE

A. Provide factory authorized startup services to assure its proper operation.

B. Set the boiler operating and safety controls.

C. Perform a flue gas analysis at the boiler outlet. Record the following results of the analysis:
   1. Carbon dioxide percent volume.
   2. Oxygen percent volume.
   3. Stack temperature.
   4. Calculated combustion efficiency.

D. Do not operate the boiler for any reason until the factory startup service has been completed.

E. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner/Engineer shall be present to witness test.

3.3 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:

1. Unit identification as indicated on Contract Drawings.
2. Serial Number.
3. Model Number.
4. Unit power supply: Volts / PH / Amps.
5. Sales Order #.
6. Date unit manufactured.

END OF SECTION

SECTION 23 6527
AIR-COOLED ROTARY SCROLL CHILLER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and Install a packaged, electric-driven, air-cooled, water chilling unit with multiple scroll compressors complete, heat recovery circuit and with controls.

1.2 RELATED WORK

A. Division 23 - Mechanical
   1. Chilled Water Piping
   2. Insulation
   3. Building Management Control System
   4. Vibration Isolation
   5. Electrical Provisions of Mechanical Work

1.3 REFERENCES

A. ANSI/ARI 550/590 - Water Chilling Packages using the Vapor Compression Cycle.
B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
E. ANSI/NEMA MG 1 - Motors and Generators.
F. ANSI/UL 465 - Central Cooling Air Conditioners.
G. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than 200,000 hours.
H. ANSI/NFPA Standard 70 - National Electrical Code (NEC)
I. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
K. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
L. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments.

1.4 PERFORMANCE

A. Provide performance as scheduled on drawings. Provide factory run test to ensure proper chiller operation. Provide certified documentation to Owner in Closeout Documents.

1.5 WARRANTY

A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty and maintenance service agreement for a period of five (5) years from substantial completion.
   1. The warranty shall include, but not be limited to the compressor assemblies including motor, condensers, fans, variable frequency drives, controls, evaporator, condenser, refrigeration system and all other auxiliary components and accessories as well as refrigerant and oils in systems.
   2. In the event of failure, provide new or factory authorized rebuilt parts. Shop or job site rebuilt parts are not acceptable.
   3. On all manufacturers warranties the chiller manufacturer shall provide a factory certificate listing as a minimum chiller model, serial, and warranty information as specified above. Each chiller tag shall be provided with an individual and unique warranty certificate. Manufacturer's representative warranty letters are not acceptable as an alternative to the original manufacturer's certificates.
   4. The chiller manufacturer authorized service agency is required to perform any and all warranty service. Contractor warranty service is not authorized. Warranty work shall be performed with District Representative present.

1.6 SUBMITTALS

A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.

B. Submit the following information:

1. Manufacturer's installation instructions.
2. Minimum Circuit Ampacity.
3. Maximum Overcurrent Protection size.
4. Maximum conductor / Terminal Lug size.
5. Minimum flow thru evaporator.
6. Electrical interlocks.

C. Submit recommended clearance dimensions for air flow and service.

D. Submit coordination drawings as specified.

1. Give consideration to adjacent structures as they affect air flow patterns.

E. Submit internal wiring diagram of Control Center.

F. Submit sequence of operation in narrative form.

G. Submit a letter stating chiller being proposed meets the efficiency requirements of Centerpoint Energy's Score Program listed in Centerpoint Energy's Design Guide: HVAC Recommendations document.

H. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.7 STORAGE/HANDLING/SHIPPING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

C. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

2.2 COMPRESSORS

A. Provide a minimum of two independently circuited hermetic rotary scroll type compressors with the following:

1. Direct drive, 3600 rpm, suction gas-cooled hermetic motor.
2. Rubber isolation pads.
3. Crankcase heaters.
4. Oil sight glass.
5. Load and unload solenoid valves.
6. Discharge oil separator.
7. Hot gas bypass for compressor unloading.
8. Centrifugal oil pump.
9. Oil charging valve.

B. Provide capacity modulation from 100% to 25% via compressor cycling.

1. Control to be based upon leaving chilled water.
2. To avoid excessive compressor cycling while maintaining leaving chilled water temperature at desired temperature +/- differential, compressor cycling set points to be separated by a minimum 20% capacity dead band.

C. Unit shall be equipped with factory installed Ultra-Low Sound Compressor Sound Reduction enclosure the encases each compressor. The sound reduction enclosure shall meet or exceed 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 if scheduled dBA is met without.

2.3 CONDENSER COILS

A. Coils shall be one of the following:
   1. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Long Life Alloy Microchannel shall pass 4500hr salt spray rating uncoated.
   2. The condenser coils shall consist of 0.375 inch seamless copper tubes mechanically bonded into plate-type fins. The fins shall have full drawn collars to completely cover the tubes.

B. Protect all vertical or angled coil sections from hail or physical damage with corrosion resistant louvered hail guard including chiller ends, factory installed to cover compressor and condenser sections.

C. Field adjustable head pressure based fan cycling controls for each circuit capable of maintaining minimum head pressure down to 20°F unless noted otherwise.

D. Protect condenser coils during shipping.

E. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.4 FANS AND MOTORS

A. Direct drive ultra-quiet nine blade fans propeller type fans.
   1. Vertical discharge with sound reduction without performance reduction.
   2. Protect fan blades with a heavy-gauge wire guard.
   3. Statically and dynamically balanced.
   4. Sound reduction engineered heavy-duty molded plastic blades designed to reduce airflow turbulence.

B. Motors with built in thermal overload protection
   1. Permanently lubricated ball bearings.
   2. Weatherproof (TEAO or TEFC) motors.
   3. Variable frequency drive on each condenser fan circuit.

2.5 COOLER/EVAPORATOR

A. Provide a tube-in-shell direct expansion cooler for the evaporator.
   1. Tube-in-shell direct expansion cooler
      a. Copper tube and steel shell construction
      b. 300 psig water side working pressure
      c. ASME coded 225 psig refrigerant side working pressure
      d. Fully independent refrigerant circuit for each compressor.
      e. Serviceable construction including removable heads and field replaceable tubes.
      f. Drain and vent connection.
      g. Inlet strainer.

B. Protect cooler with ambient controlled heater cable and minimum 1-1/2" thick flexible elastomeric rubber closed cell insulation. Heater cable to protect evaporator to -20°F (-29°C). Heater cable shall be wrapped helically around the shell under the insulation.

C. Protect insulation and equipment from abrasion by unit enclosure.

D. After completion of successful start-up, installing contractor shall seal all openings.

E. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.

F. All water connections to Evaporator shall be provided with factory flanged connections.

2.6 CASING/ENCLOSURES

A. House components in minimum 12 gauge galvanized steel frame and mounted on welded

structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.

B. Unit panels, and control panels shall be 14 gauge, finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.

C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 672 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8"). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

E. Coated wire mesh to limit access beneath the condenser coils, cooler, and compressor section area.

F. Convenience outlet (GFIC) at control panel connected to 120-vac circuit provided for heat tracing on cooler.

G. A control power transformer shall be factory installed to provide unit control power.

2.7 REFRIGERANT CIRCUIT

A. All units shall have a separate independent refrigerant circuit for each compressor. Twenty & 30 Ton single circuit; 40, 50 & 60 Tons, dual individual refrigerant circuits.

B. Provide for each refrigerant circuit:

1. Liquid line isolation valve.
2. Filter dryer (replaceable core type).
3. Liquid line sight glass and moisture indicator.
4. Electronic or thermal expansion valve sized for maximum operating pressure. Expansion valves with less than five years of proven field operation are not acceptable.
5. Charging valve.
6. Discharge and oil line check valves.
7. Compressor suction and discharge service valves.
8. Relief valve.
9. Full operating charge of refrigerant and oil.
10. Unit factory leak tested at 200 psig.

2.8 CONTROL PANEL

A. The Control Center.

1. NEMA 3R weatherproof cabinet with hinged lockable outer door.
2. Control system.
3. Solid-state compressor three phase motor protection.
4. Single point field power connection points.
5. Control interlock terminals.
6. Fan motor and control circuit fuses.
7. Individual contactors for each fan motor.
8. Unit power terminal blocks for connection to remove disconnect switch.
9. Power supply terminals for evaporator heater circuit.
10. Dead front panels over line voltage.
11. Control power / circuit transformer.
12. Provide incoming power terminals, sized to accept the feeder conductors.

13. Chiller run and alarm status relay cards.

B. Microprocessor control system.
1. Stage unit based on leaving water temperature control.
2. Oil differential pressure setpoints.
3. Motor protection.
4. High pressure alarm.
5. Loss of refrigerant alarm.
6. Loss of water flow alarm.
7. Freeze protection alarm.
8. Low refrigerant pressure alarm.
9. Auto start/stop switch.
10. Chilled water setpoint adjustment.
11. Anti-recycle timer.
12. Compressor run status.
13. Password protection.
14. Low water temperature safety (freeze protection).
15. Automatic pump down cycle.
16. Limit supply water temperature pull down on start up to 1° per minute.
17. Automatic lead-lag sequence change of compressors.
18. Unload the compressors if the return water is too high.
19. Compressor starts with the controlled cylinders unloaded.
20. Reset of the chilled water temperature.
21. Indicate status of safeties.
22. Non-volatile memory (EPROM) with setpoints retained with battery backup.
23. Automatic high pressure unloader to unload compressor at pressures above 375 psig.
24. Auto restart after power failure.
25. Alarm Relay
26. Percent of Running Load Amperage
25. BacNET interface

C. Display the following information with 16 key keypad with two line x 40 character clear English Display for outdoor viewing.
1. Supply and Return water temperature.
2. Low water temperature cutout setting.
3. Low ambient temperature cutout setting.
4. Outdoor air temperature.
5. English and Metric data.
6. Suction pressure cutout setting.
7. Each system suction pressure.
8. Each system discharge pressure.
9. Each system oil pressure.
10. Percent of full load motor current.
11. Liquid control range. (2.0 - 20°F above setpoint).
12. Liquid pulldown rate sensitivity adjustment.
13. Anti-recycle timer status for each compressor.
12. Compressor starts & operating run hours.
13. Safety shutdown shall be date and time stamped.
14. Compressor run status.
15. History and alarm diagnostic memory display.

D. All control functions and information shall be available at the unit control panel or via RS 232 cable and phone modem to personal computer.

E. Chiller shall include a relay board with dry contacts for alarms to notify a Building Automation System of certain events or statues of the chiller.

F. Chiller shall include input for leaving chilled water temperature setpoint based upon a 2-10VDS or 4-20mA signal from a Building Automation System.

G. Chiller shall include input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.
B. Where the chiller unit is mounted on a grade, a concrete pad shall be provided that is a minimum of 4" high and extends 6" all around the chiller.
C. Align chiller package on steel or concrete foundations.
D. Locate away from overhead restrictions. Maintain side clearances according to manufacturer's recommendations and maintain overhead clearance to allow full elimination of hot air discharge.
E. Install units on vibration isolation pads.
F. Arrange piping for easy dismantling to permit tube cleaning, removing and or repair.
G. Level chiller.
H. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring at cooler and suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation.
I. Provide a flexible pipe connection at both the chiller inlet and outlet.

3.2 CHILLER MANUFACTURER START-UP/ FIELD SERVICES

A. Provide the services of a factory trained service technician employed full time by the chiller manufacturer to start-up the system. Technicians, as required, shall be factory trained and experienced in the work they perform. (Contractor startup is unacceptable.)
B. The technicians shall utilize comprehensive report forms to document results. Sample forms shall be submitted for review prior to commencing work.
C. Upon completion of the work, the report forms shall be signed by the technicians and their supervisor and included in the final report and Owner's manual.
D. Submit four copies of the final report to the Architect/Engineer for approval within 10 working days of start-up.
E. Follow the manufacturer's start-up procedures.
    1. Verify interlocks.
    2. Test and verify operation of safety controls.
    3. Calibrate controls.
    4. Verify microprocessor based control operation.
    5. Test, calibrate, and set the chilled water temperature controls.
    6. Verify chilled water temperature reset sequence.
    7. Verify operation of the integrated control panel.
F. Measure and record the following data:
    1. Chilled water entering/leaving temperature.
    2. Chilled water flow through the chiller.
    3. Suction pressure/condensing pressure.
    4. Suction pressure/unloading steps.
    5. Air entering/leaving condenser; dry bulb temperature.
    6. Outdoor ambient; dry bulb.
    7. Motor nameplate voltage; phase and full load amperes.
    8. Heater coil in starter (as applicable)
        a. Rating in amperes.
        b. Manufacturer's recommendation.
    9. Power reading (voltage and amperes of legs at motor terminals).
G. Test and calibrate the operation of the electronic ground current sensing devices.
H. If the system has been shipped with a holding charge, provide the following:
    1. Leak test.
    2. Refrigerant pressure test.

3. Evacuate, dehydrate and charge.

I. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.

J. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.

K. Do not operate the equipment for any reason until the factory start-up service has been completed.

L. Provide a print-out from the unit micro-computer control system showing the correct operation of all system controls and components.

M. Provide minimum 24 hour history log displaying accuracy of temperature control system in 15 minute intervals and documented number of compressor cycles during the 24 hour period.

3.3 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:

1. Unit identification as indicated on Contract Drawings.
2. Serial Number.
3. Model Number.
4. Capacity (Tons)
5. Unit power supply: Volts / PH / Amps.
6. Sales Order #.
7. Date unit manufactured.

END OF SECTION

SECTION 23 7313
AIR HANDLING UNITS

1.1 WORK INCLUDED
A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.2 RELATED WORK
A. Division 23 Mechanical
   1. Air Balance
   2. Ductwork
   3. Controls
   4. Electrical Provisions of Mechanical Work
   5. Air Filtration
   6. Heating and Cooling Coils
   7. Other applicable sections

1.3 PERFORMANCE
A. Unit capacities and characteristics as indicated.
   1. Units must be certified in accordance with ARI Standard 430-66.
   2. UL 1995 certification for safety including electric heat.
   3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS
A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.
   3. Chart of specific sound power level at each octave band center frequency.
   4. For variable volume units, plot fan volume over entire range.
C. Submit for review a unit internal static pressure loss calculation.
   1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
      a. Coils
      b. Dirty filters
      c. Fan and unit system effect
      d. Cabinet and cabinet inlet and outlet
      e. Unit mounted dampers
   2. If a unit mounted outside air pretreatment section without supply fan, “piggyback” is specified:
      a. Provide an itemized static pressure loss as indicated above.
      b. Determine losses for unit configuration, i.e. parallel or series.
      c. Include losses in the primary unit internal static pressure required by configuration.
   3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS
A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier
B. JCI
C. Trane

2.2 MISCELLANEOUS REQUIREMENTS

A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
D. Unit casing panels shall be a minimum of 2” double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.
E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).
F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.
G. Provide factory installed removable hinged access doors in the following locations:
    1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
    2. Each side of filter compartment to allow changing of filters from either side.
    3. Each side of motor compartment to allow motor and isolation access.
    4. Each side of condensate drain pan to allow for cleaning and inspection.
    5. Swing the doors against the casing static pressure.
H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10” minimum downstream of cooling coil.
I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

2.3 DRAW THROUGH AIR HANDLING UNITS – CONSTANT VOLUME

A. Provided with:
    1. V-belt drive assembly and motor with totally enclosed belt guard.
    2. Insulated sheet metal cabinet with removable panels for access to the interior.
    3. Full hinged double wall doors with two-step safety handles.
B. Drive assembly:
    1. Size for 50% overload.
    2. Matched belts.
    3. Minimum two belt drive.

4. Provide adjustable pitch motor pulley for motors.
5. Provide motor and fan pulley of cast iron keyed to the shaft.

C. Select the motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
1. Totally enclosed, fan cooled, 1750 rpm.
2. Minimum 90% nominal efficiency at loads of 70% to 100%.
3. Premium efficiency
4. Cast iron frame and end plate
5. Forged steel lifting eye
6. Oversized conduit box with ground lug
7. Provide with factory installed shaft grounding ring by Aegis on units which utilize a variable frequency drive.

D. Supply Fans:
1. Double width, double inlet, forward curve blades.
2. Statically and dynamically balanced.
3. Tested after being installed in the fan sections.
4. Selected for the design air quantities and pressure of the system.
5. Mounted on a common shaft if multiple wheels.

E. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

F. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.

G. Fan bearings:
1. Remote grease fittings grouped on the motor access side of the unit.
2. Self-aligning.
3. Select for an average life of 200,000 hours.

H. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.

I. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.

J. Filter section:
1. Constructed with substantial hinges.
2. Neoprene gasketing.
3. Permanent quick release latching devices.
4. Arranged to accommodate the 2" thick filters as specified.
5. Low velocity angled filter section unless otherwise specified.
6. Filters shall be easily accessible through access door with handles and shall not require tools to access and remove.

K. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

L. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
1. Location as indicated.

2.4 DRAW THROUGH AIR HANDLING UNITS – VARIABLE AIR VOLUME

A. Provided with:
1. V-belt drive assembly and motor with totally enclosed belt guard.
2. Insulated sheet metal cabinet with removable panels for access to the interior.
3. Full hinged double wall doors with two-step safety handles.

B. Drive assembly:
1. Sized for 50% overload.
2. Matched belts.
3. Minimum two belt drive.

C. Select proper fan drives from an assortment of fixed pitch cast iron pulleys and matched belts.
   1. Pulleys keyed to the shaft.
D. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
   1. Totally enclosed, fan cooled, Variable speed.
   2. Minimum 90% nominal efficiency at loads of 70%-100%.
   3. Premium efficiency.
   4. Cast iron frame and end plate
   5. Forged steel lifting eye
   6. Over sized conduit box with ground lug
   7. Provide with factory installed shaft grounding rings by Aegis
E. Supply fans shall be:
   1. Double width, double inlet, non-overloading, air-foil blade centrifugal fan, or forward curve fan as required.
   2. Statically and dynamically balanced
   3. Tested after being installed in the fan sections
   4. Mounted on a common shaft if multiple wheels
F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
G. Stainless steel condensate pan with positive slope in all directions to outlet; condensate drain pan with a minimum of 1-1/2" waterproof insulation.
H. Fan bearings:
   1. Remote grease fittings grouped on the motor access side of the unit.
   2. Self-aligning.
   3. Selected for an average life of 200,000 hours.
I. Insulation, vapor barriers, facings and adhesives shall have:
   1. Flame spread not higher than 25.
   2. Smoke developed rating not higher than 50.
   3. 3 lb. density insulation in interior casing panels.
J. Double wall casing construction. Construct interior casing panels with 3 lb. Minimum density insulation for acoustical and condensate control.
   1. Condensation on the exterior of the air handling units is not acceptable.
K. Filter Section:
   1. Constructed with substantial hinges.
   2. Neoprene gasketing.
   3. Permanent quick release latching devices.
   4. Arranged to accommodate 2" thick filters as specified.
   5. Low velocity angled filter section unless otherwise specified.
   6. Filters shall be easily accessible through access door with handles and shall not require tools to access and remove.
L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
N. Equipment capacities as indicated.
O. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air handling units according to manufacturer's instructions.
B. Provide additional drive packages as required by the Testing and Balancing firm.

C. Air leaks detectable by sound or touch are to be corrected.
D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.
E. All coils are to be cleaned prior to substantial completion if units are used during construction.
F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.
H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
J. Align belts to eliminate wear and vibration of belts.
K. Verify correct drainage of condensate from condensate pan.
L. Verify correct rotation of fan and wiring of motor.
M. Lubricate all greaseable ball bearings with manufacturer’s suggested lubricant.
N. Replace filters as required if units are used during construction.
O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

3.2 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:
1. Unit identification as indicated on Contract Drawings.
2. Area served by unit
3. Serial Number.
4. Model Number.
5. Capacity (CFM) and static pressure.
6. Motor HP.
7. Unit power supply: Volts / PH / Amps.
8. Supply Fan Type.
9. Coil GPM and pressure drop.
10. Size and number of filters
11. Sales Order #.
12. Date unit manufactured.

END OF SECTION

SECTION 23 8124
WEATHERPROOF ROOF-MOUNTED AIR HANDLING UNIT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Weatherproof roof-mounted air handling units and related roof curb. Units shall be constructed for outdoor installation.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Ductwork
   3. Controls
   4. Electrical Provisions of Mechanical Work
   5. Air Filtration
   6. Heating and Cooling Coils
   7. Vibration Isolation
   8. Other applicable sections

1.3 PERFORMANCE

A. Unit capacities and characteristics as indicated.
   1. Units must be certified in accordance with ARI Standard 430-66.
   2. UL 1995 certification for safety including electric heat.
   3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.
   3. Chart of specific sound power level at each octave band center frequency.
   4. For variable volume units, plot fan volume over entire range.

C. Submit for review a unit internal static pressure loss calculation.
   1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
      a. Coils
      b. Dirty filters
      c. Fan and unit system effect
      d. Cabinet and cabinet inlet and outlet
      e. Unit mounted dampers
   2. If a unit mounted outside air pretreatment section without supply fan, “piggyback” is specified:
      a. Provide an itemized static pressure loss as indicated above.
      b. Determine losses for unit configuration, i.e. parallel or series.
      c. Include losses in the primary unit internal static pressure required by

configuration.

3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

1.7 WARRANTY

A. The Air Handling Unit manufacturer shall provide a full machine parts and labor warranty for a period of one (1) year from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. JCI

C. Trane

2.2 MISCELLANEOUS REQUIREMENTS

A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option for oversize shipping reasons only.

B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.

C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.

2.3 UNIT HOUSING

A. Construct the unit housing of galvanized steel sheets.
1. Unitized structural steel frame and base with gusseted corners.
2. Braced and of sufficient strength to prevent "breathing".
3. Construct to accommodate the weight of a 250 lb. man at any location on the top.
4. Completely weatherproof and sloped for drainage.
5. Make casing joints water tight with approved sealant.

B. Unit casing panels shall be double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the

design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections. Condensation on exterior of the air handling unit is not approved.

C. Fan assembly shall be provided with 1-inch deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2-inch deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge.

D. Provide factory installed full size, gasketed, removable, hinged access doors in the following locations:
1. Entering and leaving side of all coils to allow for cleaning of coils on both side of unit.
2. Each side of filter compartment to allow changing of filters from either side.
3. Each side of motor compartment to allow motor and isolation access.
4. Each side of condensate drain pan to allow for cleaning and inspection.
5. Swing the doors against the casing static pressure.

E. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10” minimum downstream of cooling coil.

F. Provide coils with stainless steel casings, end plates, tube supports and top and bottom plates.

G. Provide doors for motor and filter compartments with door swing away from piping connections.

H. Exterior of unit shall be weatherproof and shall pass a 500-hour salt spray test.

I. Use stainless steel fasteners with stainless steel piano hinges; latches with zinc plated, epoxy coated T-bar handles; and air tight gaskets.

J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

K. Provide outside air damper and outside air hood component. A motorized outside air damper actuator shall be provided in the Building Management and Controls specification.
1. Storm proof louvers
2. Outside air dampers as specified

2.4 SUPPLY FANS

A. Supply:
1. Double width, double inlet, non-overloading, air foil blade centrifugal fan, or forward curve fan as required.
2. Statically and dynamically balanced
3. Tested after being installed in the fan section
4. Selected for the design air quantity and pressure of the system
5. Mounted on a common shaft if multiple wheels
6. Minimum of Class II fans.

B. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

C. Nominal fan outlet velocities shall not exceed 1800 FPM.

D. Fan bearings:
1. Remote grease fittings grouped on the coil connection side of the unit.
2. Self-aligning.
3. Selected for an average life of 200,000 hours.

2.5 OUTSIDE AIR DAMPER

A. Opposed blade dampers for 2 position and modulating control.
1. Ruskin Model CD 60

2.6 DRIVE ASSEMBLY

A. Size for 50% overload

B. Match belts

C. Minimum two belt drive Type “B” only (5/8” wide)

D. Provide adjustable pitch motor pulley for motors.

E. Provide motor and fan pulley of cast iron keyed to the shaft.

F. Fan bearings:
1. Greaseable bearings
2. Remote grease fittings grouped on the motor access side of the unit.
3. Self-aligning.
4. Select for an average life of 200,000 hours.

2.7 FAN MOTOR

A. Select the motor so the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
1. TEFC, 1750 rpm
2. Minimum 90% nominal efficiency at loads of 70% - 100%.
3. Premium efficiency.
4. Cast iron frame and end plate
5. Forged steel lifting eye
6. Oversized conduit box with ground lug
7. Provide with factory installed shaft grounding ring by Aegis on units which utilize a variable frequency drive.
8. Greaseable bearings for motors.

B. Install motor and drive assembly in the unit housing.

C. Mount the fan and motor on a common vibration isolation base selected for the fan frequency.
1. Adjustable slide rail for belt tension adjustment
2. Housed adjustable springs

2.8 FILTER SECTION

A. Constructed with substantial hinges.

B. Neoprene gasketing.

C. Permanent quick release latching devices.

D. Arranged to accommodate the 2" thick filters as specified.

2.9 COILS

A. Reference coil section of specifications.

2.10 ROOF CURB

A. Provide a roof curb of the same manufacturer as the air-handling unit. The curb will support the unit and provide a watertight enclosure to protect ductwork and utility services. Use a design complying with National Roofing Contractors Association requirements. Coordinate slope of roof prior to ordering curbs.
   1. The assembly of the unit and roof curb shall be rated for 150 MPH winds. Provide engineered drawings certifying this requirement is met.
   2. Furnish through-the-curb electrical service connection with a raised area for penetrations.
   3. Provide curb with integrated coil connection housing as indicated on drawings.
   4. Refer to 23 05 48 Vibration Isolation specification for additional information.

2.11 EXTERNAL PIPE CABINET

A. Supplied by unit manufacturer.
   1. Factory assembled
   2. External of unit
   3. Hinged 30-inch wide access doors of same construction on each side.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unit is to be provided with a through-the-bottom service connection accessory package and must be used for electrical connections to unit. Use bulkhead connectors to make a waterproof connection.

B. Seal all duct connections to roof curb for air tight connection. Install a 90 degree flanged ductwork connection to the roof curb. Provide and install gasketing around duct flanges. Provide and install gasketing around outer edge of roof curb.

C. Install air handling units according to manufacturer's instructions.

D. Provide additional drive packages as required by the Testing and Balancing firm.

E. Air leaks detectable by sound or touch are to be corrected.

F. Air handling units are to be properly supported to prevent flexing, bending or distorting

base rails.

G. All coils and drain pans are to be cleaned prior to substantial completion if units are used during construction.

H. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.

I. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.

J. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.

K. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.

L. Align belts to eliminate wear and vibration of belts.

M. Verify correct drainage of condensate from condensate pan.

N. Verify correct rotation of fan and wiring of motor.

O. Lubricate all greaseable ball bearings with manufacturer’s suggested lubricant.

P. Replace filters as required if units are used during construction.

Q. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

R. AHU motors must be wired with Kernay connections inside motor terminal boxes. No wire nuts. Kernay connections must be wrapped with rubber and electrical tape for insulation.

3.2 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:
1. Unit identification as indicated on Contract Drawings.
2. Area served by unit
3. Serial Number.
4. Model Number.
5. Capacity (CFM) and static pressure.
6. Motor HP.
7. Unit power supply: Volts / PH / Amps.
8. Supply Fan Type.
9. Coil GPM and pressure drop.
10. Size and number of filters
11. Sales Order #.
12. Date unit manufactured.

END OF SECTION

SECTION 23 8216
HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

A. Submit manufacturer's product data sheets and unit capacity information as specified.
B. Submit manufacturer's Installation, Start-Up and Service Instructions.
C. Submit internal wiring diagram.
   1. Electrical interlocks.

1.3 RELATED WORK

A. Division 23 Mechanical.
   1. Air Handling Units.
   2. Fan Coil Units.
   3. Weatherproof Roof Mounted Air Handling Units.
   4. Ductwork.
   5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

A. Hot water coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for hot water.
      a. Maximum temperature 200°F.
B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations where the incoming air is not filtered, the maximum approved fin spacing is 8 fins per inch.
C. Non-trapping circuit design:
   1. Working pressure 200 psi
   2. Tappings for drain and air vent
D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
   1. Positioned to permit accurate pressure readings.
E. Coils shall be constructed in casings as required for installation.

2.2 CHILLED WATER COILS

A. Chilled water coils:
   1. Constructed of copper tubes and aluminum fins
   2. Designed and circuited for chilled water
   3. Minimum of six rows
B. Non-trapping circuit design:
   1. Working pressure 200 psi.
   2. Tappings for drain and air vent.
C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.
D. Coils shall be constructed in casings as required for installation.
E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 DIRECT EXPANSION COOLING COILS

A. DX cooling coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for use with direct expansion refrigeration.

B. Cooling coil face velocity:
   1. Not of magnitude to cause moisture to be carried off the coil.
   2. Maximum velocity as scheduled.
C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.
D. Coils shall be constructed in casings as required for installation.
E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.4 ELECTRIC HEATERS

A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.
C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.
D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.
H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

SECTION 23 8218
DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall mounted indoor fan coil section with wired controller and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with constant speed compressor, pre-charged with R32 or R454B refrigerant. Air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

A. Refrigerant Piping.
B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.
B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.
D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).
E. A pressure charge of R32 or R454B refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.
F. A dry air holding charge shall be provided in the indoor section.
G. System efficiency shall meet or exceed 13.0 SEER.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Mitsubishi

2.2 INDOOR UNIT GENERAL

A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.
B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.
C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.3 UNIT CABINET

A. The casing shall have a smooth front, top return, in a Munsell No. 1.0Y 9.2/0.2 white finish.
B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the

responsibility of the installer.

2.4 FAN

A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.
B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 FILTER

A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 COIL

A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.
B. Tubing shall have inner groves for high efficiency heat exchange.
C. All tube joints shall be brazed with PhosCopper or silver alloy.
D. The coil shall be pressure tested at the factory.
E. A sloped condensate pan and drain with extension hose shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. (Option: A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.)

2.7 ELECTRICAL

A. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.
B. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

A. This system shall have a wired controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.
C. There shall be a 24 hour On / Off timer.
D. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.
E. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
F. The system shall be capable of automatic restart when power is restored after power interruption.
G. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

A. The outdoor unit is designed specifically for use with MS series indoor units. These units are equipped with a circuit board that interfaces to the MS indoor unit circuit board. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
B. When refrigerant lines are exposed on exterior of building provide “LINE-HIDE” line set

cover system.
1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
2. Assembly Screws, stainless steel.

2.10 UNIT CABINET

A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.

B. Case and mounting feet shall be as follows:
1. The MS-A09WA base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
2. The base for the MS-A12WA shall have a galvanized steel base with welded mounting feet.

C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 FAN

A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.

C. The fan shall be provided with a raised guard to prevent contact with moving parts.

D. The outdoor unit shall have horizontal discharge airflow.

2.12 COMPRESSOR

A. The compressor shall be a high performance, hermetic, rolling piston, rotary type.

B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.

C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.13 OPERATION

A. The outdoor unit shall have an accumulator.

B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.

C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.

D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.14 ELECTRICAL

A. The electrical power of the system shall be 115 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.

B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

2.15 A2L REFRIGERANT LEAK DISSIPATION SYSTEM

A. Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40, integrated with unit controller.

B. System shall be designed for the life of the unit.

C. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.

D. Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.

E. Factory-installed dissipation system shall use onboard microprocessor and include:
1. Automatic leak detection and dissipation algorithm.
2. Automatic reset after a dissipation event has occurred.
3. Onboard LED with flash code to indicate current unit status and hardware failures.
4. Depressible “Test” button to allow for a system test and recall/reset of leak detection history.
5. 24-v dry contact alarm terminal on dissipation control board to allow for external notification of leak detection.
6. Ability to notify BAS system of dissipation event via readable alarm point unit controller.
7. Recallable dissipation alarm history on unit controller.

F. Dissipation control board shall be accessible via normal maintenance locations and LED shall be visible.

G. Dissipation system shall “Fail Safe” per UL requirements.

H. Dissipation shall allow smoke and building fire systems to override in case of event.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.

B. Install units on vibration isolation pads.

3.2 CONTROL WIRING

A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendations.

B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 WARRANTY

A. The units shall have a manufacturer’s parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

3.5 START-UP

A. Follow the manufacturer's start-up procedures.

B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring op suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION

SECTION 23 8219
FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Floor mounted decorative cabinet fan/coil units, horizontal fan/coil units for concealed installation and horizontal exposed ceiling mounted fan/coil units with decorative cabinet.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Controls
   3. Electrical Provisions of Mechanical Work
   4. Ductwork
   5. Air filtration

1.3 REFERENCES

A. ANSI/AHRI 410 - force circulation air cooling and air heating coils
B. National Electrical Code

1.4 SUBMITTALS

A. Submit manufacturer's dimensioned product data sheets.
   1. Show location of filter access doors.
B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.
C. Submit the fan performance plot at each motor speed position with consideration for the reduced internal static.
D. Submit a chart of specific sound power level at each octave band center frequency.
E. Submit manufacturer's certified heating and cooling coil capacity data.
F. Submit filter manufacturer's product data sheets and capacity information.
G. Submit manufacturer's data on housing insulation material.

1.5 CAPACITY

A. Refer to equipment schedule.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier
B. JCI
C. Trane

2.2 COMPONENTS

A. Fan section
B. V-belt drive assembly, or,
C. Multi-speed direct connected motor
D. Filter section
E. Coil section
F. Insulated sheet metal cabinet with removable panels for access to the interior
G. Motor and drive inside the cabinet

2.3 FAN SECTION

A. Locate the motor and drive assembly inside the cabinet.
B. Size each v-belt drive for 50% overload.
   1. Adjustable pitch motor pulley

2. Provide built-in motor protection
3. Belt adjustment means

C. Provide multi-speed direct connected fan motor with built-in motor protection.
1. Three-speed windings
2. Factory wired to a junction box with provisions for motor speed change, mounted on the box
3. Resiliently mounted

D. Select the fan motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate amperage rating.

E. Supply Fans:
1. Double width, double inlet, forward curve blade
2. Statically and dynamically balanced
3. Tested after being installed in the fan section
4. Selected for the design air quantities and static pressure of the system
5. Mounted on a common shaft if multiple wheels

F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

G. Fan Bearings:
1. Permanently lubricated
2. Self-aligning

2.4 DECORATIVE HOUSING AND PLENUM

A. Where units are exposed to view in occupied spaces and where scheduled, construct cabinets of cold rolled steel, bonderized and coated with baked enamel finish.

B. Access panels shall have position locking fasteners for easy removal.
1. Plated screws with captive nuts
2. Hinged if too large for one man operation

2.5 UNIT HOUSING

A. All cabinet walls and access doors shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

B. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.

C. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel and prevents exterior condensation on the panel.

D. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

E. Access to filters, cooling coil, reheat coil, heaters, supply fans and electrical and controls components shall be through hinged access doors. Stainless steel hinges shall be included on the doors.

F. Access doors shall be flush mounted to cabinetry, with stainless steel removable hinges and quarter-turn, zinc cast handles.

G. Condensation on the exterior of the unit is not approved.

H. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.

2.6 CONDENSATE DRAIN PANS

A. IAQ style drain pans shall be provided under all coils.

1. Pitch to drain connection
2. Fabricated from 16 gauge 304 stainless steel
3. Triple pitched for complete drainage with no standing water
4. Insulated to prevent condensation
5. Welded corners
6. Stainless drain connection

2.7 COILS

A. Reference Schedule and Specification Section 23 82 16.

2.8 FILTER SECTION

A. Locate behind access doors.
   1. Construct with substantial hinges
   2. Neoprene gaskets
   3. Permanent quick-release latching devices
B. Arranged to accommodate the 1" thick filters as specified.
   1. Single section filter
C. Provide full length tracks to support the filter.

PART 3 - EXECUTION

3.1 SPARE PARTS

A. Provide the following spare parts and material to the Owner for use after the warranty period.
   1. One spare fan motor for each size of fan motor on the project
   2. One spare set of filters or filter media for each fan coil unit on the project

3.2 ELECTRICAL REQUIREMENTS

A. Bring electrical connections to a common junction box.

3.3 STORAGE

A. Storage and shipping in accordance with manufacturer's recommendations.

3.4 INSTALLATION

A. Install unit so motor connections and filters are accessible.

END OF SECTION

SECTION 26 0105
ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:

1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Lamps, Light Engines
12. Schedule of Ballasts and Drivers
13. Schedule of Fuses
14. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the (3) completed manuals in final form to the Architect / Engineer.

1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.

D. The Architect / Engineer shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Three complete manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.

2. Format:
   a. Size: 8-1/2" x 11"
   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 flyleaf 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.
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 / 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
1) List of lubricants required

e. Manufacturer's printed operating and maintenance instructions.

f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
1) Electrical
2) Controls
3) Communications

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. Schedule of fuses

i. Complete equipment field accessible internal wiring diagrams

j. Schedule of lamps

k. Schedule of ballasts

l. Each Contractor's coordination drawings

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 26.

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.

END OF SECTION

SECTION 26 0500
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.

B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Electrical work shall comply with applicable inspection services:

1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department adopted codes with amendments
5. National Electrical Code with local amendments
6. State Regulatory Agencies
7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
9. International Energy Conservation Code
10. National Electrical Safety Code

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the 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 has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.

B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If

materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:

1. Underwriters Laboratories, Inc. (UL)
2. Factory Mutual Research Corp. (FMRC) (also referred to as "Factory Mutual Global," or "FM Global")
3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
4. Canadian Standards Association (CSA)
5. A complete listing of acceptable NRTLs is published on the OSHA website at http://www.osha.gov/dts/otpca/nrtl/.

C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.

D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner's AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.

E. Codes and Standards applicable to this Division:

1. ANSI – American National Standards Institute
   a. ANSI Z535.1, Safety Colors
   b. ANSI Z535.2, Environmental and Facility Safety Signs
   c. ANSI Z535.3, Criteria for Safety Symbols
   d. ANSI Z535.4, Product Safety Signs and Labels
2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
   a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings [ANSI, IESNA]*
3. ASTM – American Society for Testing and Materials
4. CBM – Certified Ballast Manufacturers
5. ICC – International Code Council
   a. International Building Code® (IBC)
   b. International Existing Building Code® (IEBC)
6. ICEA – Insulated Cable Engineers Association
   a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
7. IEEE® - Institute of Electronics and Electrical Engineers
   a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
   b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plans* ("Red Book")
   c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* ("Green Book")
   d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* ("Gray Book")
   e. IEEE Std 242 ™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* ("Buff Book")
   f. IEEE Std 315 ™, *Graphic Symbols for Electrical and Electronics Diagrams*
   g. IEEE Std 399 ™, *Recommended Practice for Power Systems Analysis* ("Brown Book")
   h. IEEE Std 446 ™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* ("Orange Book")
   i. IEE Std 493 ™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* ("Gold Book")
   j. IEEE Std 519 ™, *Recommended Practices and Requirements for*

Harmonic Control in Electrical Power Systems

k. IEEE Std 739 ™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* (“Bronze Book”)
l. IEEE Std 902 ™, *Guide for Maintenance, Operation , and Safety of Industrial and Commercial Power Systems* (“Yellow Book”)
m. IEEE Std 1015 ™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* (“Blue Book”)
n. IEEE Std 11oo ™, *Recommended Practice for Powering and Grounding Electronic Equipment* (“Emerald Book”)
o. IEEE Std 1584 ™, *Guide for Performing Arc-Flash Hazard Calculations*

8. IESNA – Illuminating Engineering Society of North America
   a. IESNA *Lighting Handbook*, Ninth Edition
   b. IESNA RP-1, *American National Standard Practice for Office Lighting*
   c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
9. NECA – National Electrical Contractors Association:
   a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
   b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
   c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
   d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
   e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
   f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
   g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
   h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)*[ANSI]
   i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
   j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
   k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
   l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
   m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
   n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
   o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
   p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
   q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
   r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
   s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI]
   t. NECA 420, *Standard for Fuse Applications* [ANSI]
   u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
   v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting*

Systems [ANSI]

w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]

x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]

y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]

z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]

10. NEMA – National Electrical Manufacturers Association
11. NETA – International Electrical Testing Association, Inc.:
    a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
12. NFPA – National Fire Protection Association:
    a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection®*
    b. NFPA 70™, *National Electrical Code® (NEC®)*
    c. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
    d. NFPA 101®, Life Safety Code®
    e. NFPA 110, *Standard for Emergency and Standby Power Systems*
    f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
    g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
    h. All other NFPA codes and standards except NFPA 5000
13. OSHA – Occupational Safety and Health Administration
14. IECC – International Energy Conservation Code
15. ISO – International Organization for Standardization
16. State and Local Energy Conservation Code
17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.

C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.

D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducibles and prints is a condition of final acceptance.

1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
3. Three sets of blue-line prints of each contract as-built drawing.
4. Three sets of pdf prints of each contract as-built drawing on CD.

C. 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 RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
6. Indicate exact location of all underground electrical raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all outdoor lighting poles and equipment.
12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
14. Cloud all changes.
15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this

respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
2. The responsibility for alignment of motor and driven equipment is specified in the related division.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.

B. Manufacturer’s warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.

C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

A. General: Refer to Division 1 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be

provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

A. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
   a. Utility Power: White letters on black background
      Generator Power (White letters on red background
      UPS Power: White letters on blue background
      Load Bank Circuits: White letters on green background
      Solar or Wind Power Generation: White on orange background
   b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “PANEL HA –fed from MDP-6 located in Mech. Rm. 100”). The words “fed from” and “located” shall be included in the labeling.
   c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
   d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel “HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100”)
   e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
   f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel

serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1	Receptacle Contactor C2
West Parking Lot Pole Lights	Table Recpts Lab Rm 100
Fed From Panel HA-2,4,6	Fed From Panel LA-2,4,6,8
Located Main Elec. Rm. 100	Located Mech. Rm. 110
Control Circuit-Panel LA 42	Control Circuit-Panel LA-42
Located Main Elec. Rm. 100	Controlled-Emer Shut Off Mushroom
Controlled-BMCS	Switch Rm 101

g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A

h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.

i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e. TLA.

h. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example ATS-1	Wall Mounted Lighting ATS Example ATS
Emer Power-Emer Generator	Exterior Wall Packs/Soffit Lights
Located Chiller Yard	North/West Metal Canopy Lights
Normal Power-MSB	Fed from EHA-2
Located-Mech Rm 100	Located Mech Rm 200
Serves Panel EHA	Fed From HB-4
Located-Mech Rm 100	Located Mech Rm 150

i. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.

j. Service equipment available fault current labeling: Provide a 2x3 inch label with blue lettering on contrasting background permanently affixed to the service disconnect/equipment prior to energizing the service equipment. The label shall include the date of installation and the date of calculation. The date of calculation shall be the date indicated by the Engineer of Record’s Seal on the Construction Document Electrical One-Line Diagram / Riser Drawing. Example:

SERVICE EQUIPMENT AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY

k. Above ceiling lighting control relay equipment: Provide name plate glued to bottom of ceiling T-grid below relay location. White letters on black

background with ¼" high letters on ½" tall label for digital lighting module "DLM".

3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as "corridors". Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect's final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner's motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.

B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.

E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.

3.2 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
   3. Refer to other specification sections for additional training and commissioning requirements.

B. Time to be allocated for instructions.
   1. Minimum of 20 hours dedicated instructor time
   2. 2 hours on each of 10 days
   3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. 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 training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

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, and 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 Operating and Maintenance Manual.

3.4 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.

B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.

C. Concrete pads:
   1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections

of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this 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 shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer’s minimum circuit conductors, at no additional cost to the Owner.
4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity

entering the equipment enclosures shall not exceed the equipment manufacturer's maximum recommendations.

3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.

B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.

C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.
   1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.

D. Information to be determined and applied to electrical equipment:
   1. Arc-Flash Protection Boundary
   2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 ™
   3. Working distance calculated in accordance with IEEE Std 1584a ™
   4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
      a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
   5. System phase-to-phase voltage
   6. Condition(s) when a shock hazard exists (e.g. "With cover off")
   7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   10. Unique equipment designation or code (described under "Component Identification"
   11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
   12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
   13. Date that the hazard analysis was performed.
   14. "Served from" circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   15. If applicable, the "serves" circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit

voltage / number of phases / number of wires.

16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a ™, paragraph 9.2.3.
17. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.

E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

3.12 TESTING

A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.

B. The project will not be declared substantially complete until the following has taken place.
1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
   a. Occupancy Sensor and Lighting Controls
   b. Surge protective device equipment
   c. Overcurrent devices
   d. Motor Controllers
   e. Emergency Lighting
   f. Building Fire Alarm System

3.13 LOAD BALANCING

A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, “Motor Tip Sheet #7” dated September 2005 available for download to PDF format at no charge at:
http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systemts7.pdf

END OF SECTION

SECTION 26 0505
ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspection and service of existing equipment and materials to remain or be reused.
B. Handling of equipment and materials to be abandoned.
C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.
B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
C. Verify field measurements and circuiting arrangements.
D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all

exterior and interior surfaces; rinse with clean water and wipe dry. For each luminarie that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures

C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.

D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.

F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Panelboards Reused and Modified for Renovation: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.3 SEQUENCING AND SCHEDULING

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.

C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.

D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.

E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
   1. Remove exposed conduit that has been abandoned.
   2. Cap conduit beyond the finish line.
   3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.

F. Where new/existing luminaries or devices are shown being connected to existing circuits:
   1. Field verify existing system voltage
   2. Provide ballast / device to match system voltage

G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.

H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.

I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to

make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

R. Prior to shutdown of existing power for any single extended period of time greater than 18 hours, provide at minimum 120/240 volt, 1-phase, 3-wire electrical service to provide temporary power to all critical loads as identified by Owner including but not limited to all security systems, fire alarm panel and associated remote power supplies. Contractor shall provide continuous operation temporary generator power or coordinate directly with local utility regarding temporary power service and metering and provide all necessary permits and fees at no cost to the Owner.

S. Provide a minimum 30 space panelboard with required branch circuit breakers as required and all associated temporary wiring as required. Remove all temporary power prior to substantial completion.

3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. The Contractor shall modify, remove, and/or 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 the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative

condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the following:
   a. Equipment is removed or relocated
   b. Fixtures are removed or relocated
   c. System is no longer used
   d. There is no demonstrable near term future use for the existing circuit or raceway system.
2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
   a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
   b. Removal is not feasible due to hazards, construction methods, or restricted access.
   c. Removal of abandoned conductors may damage conductors that must remain operational.
3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.
4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.

B. All items 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 relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit 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 disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.
F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
H. Repair adjacent construction and finishes damaged during demolition and extension work.
I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
K. Existing conduit raceway found to need additional hangers installed and/or junction box covers shall be added at no additional cost to the Owner.
L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
B. Provide devices and methods to protect other portions of work from damage.
C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description “existing”. Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.7 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

A. Pre-construction testing of existing low voltage systems:
   1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer’s system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
      a. Paging System.
      b. Telephone System
      c. Fire Alarm System
      d. Data Network Communications System
      e. Video Distribution System
      f. Security Access Control System
      g. Video Surveillance System.
      h. Sound Reinforcement System

2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.

B. Substantial completion testing of existing low voltage systems:
1. Provide complete operational tests of the following systems within 14-days prior to estimated date of substantial completion. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians each certified by the respective manufacturer of the existing system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
   a. Paging System.
   b. Telephone System
   c. Fire Alarm System
   d. Data Network Communications System
   e. Video Distribution System
   f. Security Access Control System
   g. Video Surveillance System.
   h. Sound Reinforcement System
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and each individual performing the tests. Provide the written report within 14 days of expected date for substantial completion.

C. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
1. Notify the Owner immediately of any disruption or damage to any low voltage system.
2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
3. For each low voltage system other than access control or fire alarm system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION

SECTION 26 0509
ELECTRIC UTILITY COORDINATION AND SERVICE ENTRANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General: Electrical service shall be provided by local utility company.

B. Power Company Data: Obtain from utility company information and installation standards for electrical service installation.

C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Service Data: Ensure that utility company service data is accurate and verified.

2.2 PRIMARY SERVICE

A. General: Division 26 shall provide primary service conduit, concrete transformer pads, concrete duct bank, utility service and metering equipment enclosures, manholes, and pull boxes as required and as specified.

B. Utility company shall provide primary cables, splices, utility metering instruments, terminations, and primary underground and overhead service conductors.

2.3 TRANSFORMERS AND SWITCHGEAR

A. General: Division 26 shall make provisions for service as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, and sleeves.

B. The utility company shall provide service transformers, primary switchgear, primary protective relaying, and connections to the customer service.

2.4 SECONDARY SERVICE CONDUCTORS

A. General: Division 26 shall provide secondary service entrance conductors, conduit and concrete duct bank.

2.5 SECONDARY SERVICE CABLE TAP BOXES

A. General: Division 26 shall provide secondary service cable tap boxes only if required or specified and as approved by the utility company. Where required or specified, enclosure shall be constructed of aluminum or stainless steel NEMA 3RX construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.

B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.

C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.

D. The materials and labor required by the for a complete installation shall be provided by the contractor and includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, metering racks and metering enclosures.

E. Utility distribution poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by the Contractor to verify their proper placement is within the Owner's property and respective utility easements. Contractor shall verify by survey that the pole and service entrance ductbank location and easements do not

interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.

F. Contractor shall initiate contact with the power provider (retail seller), utility (transmission and distribution), and Owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION

SECTION 26 0510
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide manufacturer’s qualified personnel to observe:

1. Field conditions
2. Condition of installation
3. Quality of workmanship
4. Start-up of equipment
5. Testing, adjusting, and balancing of equipment

B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 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 where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
   1. Rough-in
   2. Finish with all appurtenances in place
   3. Demonstrations
B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.
B. Coordination Drawings:
   1. Electrical room size and location required and to scale
   2. Equipment and accessories, switchgear and piping
   3. Indicate clearances and service access.

3.2 ELECTRICAL ACCEPTANCE TESTING

A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification* (ATS).
B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
   1. Installed in accordance with design documents and manufacturer's instructions.
   2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
   3. Ready to be energized.
   4. Operational within industry and manufacturer's tolerances.

3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

3.4 MOCK-UPS

A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.

END OF SECTION

SECTION 26 0511
UNDER SLAB PIPE VOID SYSTEMS FOR ELECTRICAL CONDUITS

PART 1 - GENERAL

1.1 OVERVIEW

A. This specification covers Sacrificial Pipe Void Forms, hereinafter referred to as “Pipe Voids”. Saddle Pipe Voids and Standard Pipe Voids shall always be used in conjunction with SV – Rigid/Rib Retainers as a SYSTEM to maintain void spaces below all building utility systems under building foundations during and after construction.

B. Pipe Voids serve as sacrificial falsework, which isolate critical building systems, such as domestic water, fire water, sanitary sewer utility pipes, electrical, communication conduits, and other building system piping from the potentially damaging effects of expansive soils. The Pipe Voids furnished for this project shall be in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or as established by the Engineer.

C. The Pipe Voids shall be resistant to water and UV rays and shall be chiefly comprised of carbon steel expanded metal, which is structurally efficient and biodegradable. In situations where two or more specifications apply to this work, the most stringent requirements shall govern.

1.2 PIPE VOID STRUCTURE

A. Pipe Voids shall provide a dimensionally stable void space, maintaining uniform separation between the base soil and the critical building systems. The Pipe Voids shall have sufficient structural strength to maintain the intended void space while experiencing the anticipated construction loads.

B. The Pipe Void (system) shall be designed to perform as sacrificial falsework and shall remain in place after construction and shall not be reused.

C. Serving as a structural fuse, Pipe Voids shall intercept the potential accumulation of vertical and lateral soil forces on critical building utility systems which can result from soil movement. The Pipe Voids shall intercept, absorb or redirect the forces of soil movements by crumpling, crushing, collapsing, deforming, material section degradation, soil extrusion, open corrugation load span designs or combination of any or all load relief design functions.

1.3 SUBMITTALS

A. The manufacturer’s literature shall be submitted prior to installation.

B. Submittal Drawings shall indicate layout, components, and material sizing. Include information on all components and accessories.

C. Submittals shall include a full copy of these specifications with a line-by-line compliance as required for all mandatory shop drawings. Refer to Specification 26 05 12 Electrical Shop and Coordination Drawings.

1.4 PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

1.5 RELATED SPECIFICATIONS

A. Refer to Section 26 05 33 Conduit Systems specifications for additional requirements for conduit installations which may govern the installation of the pipe void systems. It is the general intent that all conduits be installed above the building slab unless specifically indicated

as below slab on the drawings.

B. Conduits 2-inches or less in diameter for floor outlet boxes may be installed in the building slab as permitted by the structural engineer to avoid the need for a conduit pipe void system for floor box installation.

PART 2 - PRODUCTS

2.1 APPROVED PIPE VOID MANUFACTURERS MEETING ALL REQUIRED SECTION SPECIFICATIONS

A. SuperVoid Systems, LLC -www.SuperVoid.com
1172 County Rd. 24 - Prattville, Alabama 36067 –
334-730-3614 - 334-221-5761
Lprimm@SuperVoid.com; primmd@SuperVoid.com

B. Void Pipe Isolation System
Void Form Products, Inc. http://voidform.com
6151 Cowley Road - Fort Worth, TX 76119 - 888-803-VOID (8643) - 817-429-0888 (Local)

2.2 PIPE VOID MATERIAL

A. Pipe Voids shall be constructed from Carbon Steel Expanded Metal, Types I & II, conforming to ASTM F1267 and shall be assembled when required with 16ga. galvanized steel C-Rings.

B. The carbon steel shall conform to ASTM A1011.

C. All expanded metal components used for the manufacture of any Pipe Void shall fully conform to EMMA (Expanded Metal Manufacturers Association) minimum material standards.

D. All assembly and/or fabrications of the Pipe Voids shall occur entirely within the United States.

E. The Pipe Void material shall not promote the formation or emergence of mold spore, organic or other biological colonization.

F. The Pipe Voids must be able to be delivered and stored unprotected in the open jobsite environment for a minimum of 90 days without loss of design strength.

2.3 PIPE VOID MATERIAL, MINIMUM PHYSICAL PROPERTIES REQUIREMENTS

A. Pipe Void shall be naturally waterproof in terms of its intended use in this section.

B. Pipe Void shall have negligible buoyancy.

C. Pipe Void shall maintain structural integrity in 100% relative humidity.

D. Pipe Void material shall not emit offensive off-gassing odors during decomposition.

E. The structural integrity of the Pipe Void shall be unaffected by high/low ambient temperatures and elevated surface temperatures from direct sunlight extremes, above or sub-freezing, frozen soil and ice buildup.

F. Pipe Void must have an industry history of providing consistent performance integrity during and after all types of weather event applications, while in readiness storage or installed, without the threat of partial or full section premature collapse during backfill or concrete casting operations.

G. Pipe Void strength shall not be affected by becoming damp, wet, or when completely submerged in standing water.

H. Pipe Void must be fire-resistant and incombustible.

I. All Suspension Hardware to be Stainless Steel Grade, including nuts, washers & hanger rods.

J. All Suspended Piping using the Pipe Void Systems, must be permanently fixed to and permanently suspended but supported at constant elevations by structural components above.

K. All Pipe Void System protection component materials excluding hanger hardware,

backfill, piping or conduits shall be furnished per project specifications by SV-PV system manufacturer.

2.4 PIPE VOID MATERIAL, MINIMUM PERFORMANCE REQUIREMENTS

A. The Pipe Void (system) shall be designed to provide sufficient dynamic live and dead load support capacities of but not limited to all loads common to this type of construction.
B. The Pipe Void (system) shall allow the installation of utility piping and/or conduit with dead/live loads and placement of backfill materials.
C. The Pipe Void (system) shall allow manpower and foot traffic loads after application of substrates, do not walk on void components without Substrates in place.
D. Substrates shall be of those approved for use and recommended by the Pipe Void (system) manufacturer.
E. Substrate materials shall originate from FSC (Forest Stewardship Council, United States) mills and be in new or like new condition, performing to APA (The Engineered Wood Association) current standards.

2.5 RIGID RETAINER STRUCTURE

A. Rigid Retainers shall maintain a dimensionally stable void space beneath structural concrete and other critical building systems and components by physically restraining backfill material from entering the void space. The Rigid Retainers shall have sufficient structural strength to maintain the intended void space, without excessive deflection, while experiencing the anticipated lateral earth pressures.
B. The Rigid Retainers shall be designed to perform as a permanent soil retaining structure which shall remain in place after construction and shall not be reused.
C. For “Best Practice Standards,” the Rigid Retainers recommended installation is to overlap concrete castings by at least six (6) inches and extend a minimum of at least six (6) inches into the subgrade.
D. Rigid Retainers should be secured to the concrete at the top with at least three (3) anchors of sufficient size and securing strength, one at each end of the overlapping joint seal design and one centered.
E. A “Minimum Design Standard,” for the Rigid Retainers shall be designed to overlap concrete castings by at least three (3) inches and extend a minimum of at least three (3) inches into the subgrade.

2.6 RIGID RETAINER MATERIAL

A. The Rigid Retainers shall be constructed from extruded or injection molded High Density Polyethylene (HDPE).
B. The HDPE material shall be either HDPE-8 (Crate Grade) or HDPE-8 (Pail Grade).
C. The HDPE shall conform to the following: ASTM D 1238 or ASTM D 1238E, ASTM D 4883, ASTM D 638, ASTM D 790, ASTM D 256, ASTM D 2240, and ASTM D 648.
D. Rigid Retainers shall be manufactured entirely within the United States.

2.7 RIGID RETAINER MATERIAL, MINIMUM PHYSICAL PROPERTIES REQUIREMENTS

A. Rigid Retainer shall be naturally waterproof in terms of its intended use in this section.
B. Rigid Retainer shall have negligible buoyancy.
C. Rigid Retainer shall maintain structural integrity in 100% relative humidity.
D. Rigid Retainer material shall be non-biodegradable.

2.8 RIGID RETAINER MATERIAL, MINIMUM PERFORMANCE REQUIREMENTS

A. Rigid Retainers material shall provide sufficient dynamic live and dead load support capacities of but not limited to all loads common to this type of construction.
    1. Installation of backfill material – construction live loads

2. Manpower and foot traffic loads
3. Rigid Retainers material shall possess sufficient structural strength to resist anticipated lateral earth pressures.
4. Rigid Retainers must be able to be delivered and stored unprotected in the open jobsite environment for a minimum of 90 days without loss of design strength.
5. The structural integrity and installation of the Rigid Retainer shall be functionally unaffected by high/low ambient temperatures and elevated surface temperatures from direct sunlight extremes, above or sub- freezing, frozen soil and ice buildup.
6. Rigid Retainer material strength shall not be affected by becoming damp, wet, or when completely submerged in standing water.
7. These Rigid Retainer general specifications, with recommended application height and position adjustments, also apply to other Rigid Retainer assemblies such as, SV – Pipe Void Systems.

PART 3 - EXECUTION

3.1 INSTALLATION, QUALITY CONTROL

A. Install under slab electrical conduits in pipe voids with supports and fittings. Coordinate installation with structural slab drawings and specifications.

B. Install conduits, supports and fittings in accordance with pipe void system manufacture designs, recommendations, installation instructions, local codes, and applicable sections of the NECA “Standard of Installation”.

C. Installations shall be inspected by the Pipe Void System Manufacturer, their designated authorized personnel, or representatives, for installation compliance and overall quality control.

D. Provide and submit written documentation from the manufacture or their representative that the installation is consistent with the manufacturer's design and their installation instructions prior to installing any conductors in any below slab conduits installed in pipe void systems.

END OF SECTION

SECTION 26 0512
SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data

D. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
   2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

3.2 COMPOSITE COORDINATION DRAWINGS

A. Produce a set of composite coordinate drawings for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security and CCTV systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping and a composite above-ceiling plan, below slab coordination drawings, and a composite mechanical and electrical equipment room floor plan.
   1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
   2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
   3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
   4. Identify field dimensions. Show relation to adjacent or critical features of work or products.

B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
   1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
   2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
   3. Submit coordination and shop drawings prior to rough-in and fabrication.

3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submittal Specification Information:
   1. Every submittal document shall bear the following information as used in the project manual:
      a. The related specification section number
      b. The exact specification section title
   2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

C. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

D. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

E. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as

necessary for reference.

I. Identify field dimensions; show relation to adjacent or critical features or work or products.

J. Submit individually bound shop drawings and product data for the following when specified or provided. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other switchgear.

1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacture’s analysis and recommendations at no additional cost to the Owner.
2. Enclosed Switches and Circuit Breakers
3. Enclosed Motor Controllers
4. Panelboards and enclosures
5. Wiring devices
6. Lighting fixtures
7. Lighting Controls and Occupancy Sensors
8. Surge Protection Devices
9. Site Lighting Poles, Fixtures, Drivers, and Lamps
10. Electrical controls and time switches
11. Electrical Contactors
12. Motor control centers
13. Transformers
14. Switchboards
15. RTRC and/or PVC coated galvanized steel conduit and fittings conduit and fittings
16. Emergency/Standby generator sets and transfer switches
17. Surface Raceways
18. Architectural Dimming Systems
19. Theatrical Lighting Systems
20. Electrical cable trays
21. Electrical Grounding

3.4 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

3.5 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:

1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.

J. Contractor’s Stamp of Approval
   1. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
   2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
   3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
   4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

3.6 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions.
   2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer, and/or electronic data (pdf) files.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name, address and telephone number
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers

9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

3.7 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

END OF SECTION

SECTION 26 0516
EXCAVATING, BACKFILLING AND COMPACTING FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
B. Refer to Instructions for substitution of materials and products.
C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the electrical underground, and all related appurtenances. Provide concrete duct banks as specified in other related Division 26 specification sections.
B. The extent of raceways, excavation, and backfill shall be in conformance with the locations, raceways, elevations and grades shown on the drawings.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
   2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
   4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
B. Local Authority Having Jurisdiction Standards
C. Local Governing Agencies or Utilities

1.4 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete: Refer to other Division 26 specification section where concrete encasement is required or specified.
B. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.
C. Sand: Clean, local sand
D. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, organic materials, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:
   1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
   2. Refer to project Geotechnical Report for additional requirements for excavating and backfilling of utility trenches.
   3. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for

trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.

4. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the raceway placing operation to ensure a dry, firm bed on which to place the raceway.

B. Appurtenances:

1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.

C. Electrical Trenches:

1. Electrical underground raceways must be the minimum depth required by the local governing authority and Power Company.
2. Trench width for the electrical raceway shall be a minimum of the outside raceway encasement plus 12 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the conduit raceway. The conduit raceway bedding or concrete encasement shall then be placed in accordance with the specifications, local governing authority, and Power Company standard details.

3.2 BEDDING AND BACKFILL

A. Electrical Trenches:

1. Place backfill, consisting of sand or cement stabilized sand, to a depth of one foot above top of raceway or concrete duct bank and compact to 90% maximum density.
2. Backfill the remainder of the trench in 6 inch lifts with select excavated material and compact as required to achieve density of soil of surrounding area.

B. Utility Locators:

1. Provide metallic locators for utility company raceways as required by respective utility.
2. Refer to other specification sections for additional requirements for underground raceway locators and markers.

END OF SECTION

SECTION 26 0519
CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical conductors, wire and connector work as shown, and specified.

B. Types: The types of conductors and connectors required for the project include the following:
   1. 600V building conductors
   2. 600V building conductor connectors

C. Application: The applications for conductors and connectors required on the project are as follows:
   1. Power distribution circuitry
   2. Lighting branch circuitry
   3. Appliance, receptacle, and equipment branch circuitry
   4. Motor branch circuitry
   5. Control wiring
   6. Line voltage

D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CONNECTORS

A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.

B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
   1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
   2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.

C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
   1. All wiring inside lighting fixtures shall be temperature rated per NEC.
   2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

D. Cable Lubricant: Fire resistant, nonflammable, water based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/ Phase	**A**	**B**	**C**	**N**	**G**	**IG**
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.

B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.

C. Conductors:

1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
9. Provide the same size wire form the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet

from the panelboard.

10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
12. Support conductors in vertical raceways, as required by the NEC.
13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
21. Clean conductor surfaces before installing lugs and connectors.
22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
24. Run mains and feeders their entire length in continuous pieces without splices or joints.
25. Color code conductors.
26. Do not install a pull string in conduits containing conductors.
27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.

D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.

E. Splices and Joints:
   1. In accordance with UL 486A, C, D, E, and NEC.
   2. Aboveground Circuits (No. 10 AWG and smaller):
      a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220˚ F, with integral insulation, approved for copper and aluminum conductors.
      b. The integral insulator shall have a skirt to completely cover the stripped wires.
      c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.

F. Aboveground Circuits (No. 8 AWG and larger):
1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

G. Underground Branch Circuits and Feeders:
1. Submersible connectors in accordance with UL 486D, rated 600 V, 190˚F, with integral insulation.

3.2 TESTING

A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.

C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.

D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date_____

Contract and Work Location: ___
Contract (Project) No.: _
Circuit Identification: ___
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)
Applied Test Voltage _____
Normal Oper. Voltage _____
Cable Installation: New _____ Used _____
(Date) (No. Years)
Cable Size _____AWG
Cable Length _____Ft.
Cable Material _____Cu _____Al
Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

SECTION 26 0527
EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Grounding shall conform to the requirements of:
   1. National Electrical Code
   2. Governing local codes
   3. Local Utility Company

B. Ground effectively and permanently.
   1. Verify existing neutral conductor bonding at the main service disconnect and at other new/relocated or reused separately derived systems.
   2. All new/relocated conduit or cable tray systems and busway
   3. All new/relocated electrical equipment and related current carrying supports or structures
   4. All new / relocated metal piping systems
   5. All new building structural metal frames

1.2 REFERENCE STANDARDS

A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
C. Article 250 of the NEC (NFPA 70) for grounding.
D. NECA – Standard of Installation
E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Copperweld
B. nVent ERICO
C. Burndy
D. O.Z. Gedney
E. Eaton

2.2 GROUNDING ELECTRODES

A. Driven Rod Electrode
   1. 3/4" x 10'-0" copper clad grounding electrode, UL listed
   2. UL listed grounding electrode connector
   3. Approved thermal fusion methods (exothermic)
B. Metal Frame of Building
C. Existing grounding electrode system

2.3 DRIVEN ELECTRODE ACCESS BOX AND COVER

A. Hubbell Tier 22 FRP 20-inch round bolt down cover with “GROUND” embossed on top.

2.4 MATERIALS AND COMPONENTS

A. Reference other sections of this specifications for materials specified there.
B. Heavy-duty, copper, two bolt type, copper alloy or bronze compression lugs for grounding and bonding applications, in configurations required for particular installation.

PART 3 - EXECUTION

3.1 SYSTEMS 600 VOLTS OR LESS

A. In the existing service equipment, field verify existing condition of ground bus.

1. Field verify existing bond of the ground bus to the existing service grounding conductor, to the neutral bar.
2. Tighten existing ground lugs and connections.

B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
1. In rigid PVC conduit.
2. Provide thermo fusion connection for each rod ground electrode.
   a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
   b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
   c. The minimum distance between driven ground rod electrodes shall be 10'.
3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and for equipment grounds.
   a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
   b. Refer to drawings for project specific ground resistance requirements.

C. Field verify the grounding electrode conductor between the ground bus and the grounding electrode systems are in compliance with the NEC.

D. Provide an insulated grounding conductor inside all new conduits, raceways, surface raceways and cables used for power distribution. The ground wire shall be bonded to each box. All bonding jumpers shall be routed inside conduit or raceway.

E. Provide an insulated, isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and receptacles.

F. Provide all new/relocated conduits terminating in switchgear, transformers, switchboards, and panelboards with grounding bushings, where required and ground wire extended to ground bus in equipment.

G. Where modifications to the main service disconnect are required, main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.

H. Interface with lightning protection system when lightning protection system is specified.

I. Locate and install anchors, fasteners, and supports in accordance with NECA “Standard of Installation”.

J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

K. Do not use spring steel clips and clamps.

L. Do not use powder-actuated anchors.

M. Do not drill or cut structural members.

N. Do not use compression or mechanical connectors underground.

3.2 MISCELLANEOUS REQUIREMENTS

A. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be inside conduit, fittings and boxes and shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.

B. Grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable PVC raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.

C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.

D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
   1. New MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico Cadweld #B544A028 ground bar with 7/16-inch holes, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the main electrical service disconnect.
   2. New IDF Closets Telecommunications Ground Bar (TGB): Provide Erico Cadweld #B542A004 ground bar with 7/16-inch holes, mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel.
   3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
   4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
   5. Bond each equipment rack with #6 AWG insulated ground conductor to the TMGB / TGB.
   6. Route TMGB – TGB ground conductor using the shortest route practical with long radius curves.

E. Ground new and removed/replaced lighting fixture bodies to the conduit grounding system.

F. Receptacles: Provide a ground wire bonded to the conduit ground system, except where and insulated isolated grounding receptacle is specified.

G. Motor Frames: Ground the frame of each motor with a properly sized separate ground wire around flexible conduit.

H. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
   1. Access well top shall be flush with finish paved surfaces.
   2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
   3. Provide thermal fusion (exothermic) connectors approved for direct burial.

I. Ground all light poles and all exterior metal structures supporting conduit, switchgear, or light fixtures.

J. Exterior Electrical Equipment Racks:
   1. Provide driven ground electrode for racks mounted remote from building structure.
   2. Where mounted on roof, ground to be building structural steel.

K. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).

L. Transformers: Provide driven ground electrode and building steel electrode at each transformer.

M. Bond hot water and cold water piping together at each domestic water heater.

3.3 COORDINATION

A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.4 TESTING

A. Ground Resistance Test: Perform a ground resistance test for comparison to future

inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.

1. Inspect and test in accordance with NETA ATS except Section 4
2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13

B. The Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.

C. Two-Point Bonding Measurements: The two-Point Bonding test shall be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms).

D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

SECTION 26 0533
CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

A. National Electrical Code
B. Local codes and ordinances
C. UL
D. ETL

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Raceways:
   1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit
   2. PVC Coated RGC: Perma Cote or Plasti-Bond, – no exceptions
   3. Stainless Steel: Calbrite, Gibson
   4. Aluminum: American Conduit/Sapa, Wheatland, Eaton B-Line, Patriot Aluminum Products
   5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass, United Fiberglass

B. Fittings:
   1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.
   2. PVC Coated ferrous fittings: Perma-cote or Plasti-Bond, – no exceptions
   3. Stainless Steel: Calbrite, Gibson, Crouse Hinds
   4. Aluminum: American Conduit/Sapa, Wheatland, Eaton B-Line, Patriot Aluminum Products
   5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

C. Condulets and Conduit Bodies:
   1. Appleton, Form 85
   2. PVC Coated: Perma-cote or Plasti-Bond, – no exceptions
   3. Stainless Steel: Calbrite, Gibson, Crouse Hinds
   4. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

2.2 GENERAL

A. The minimum conduit size shall be ¾-inch unless indicated otherwise in Divisions 26, 27 or 28.
   1. Branch Circuits: Minimum conduit size for dedicated outlets shall be ¾-inch. Minimum conduit size from branch circuit panel to first outlet box of a multi-outlet branch circuit shall be 3/4-inch. Minimum conduit size from first outlet box to additional outlet boxes of a multi-outlet branch circuit where the conduit is installed above accessible ceilings or inside metal stud walls shall be ½-inch.
   2. Feeder Circuits: Minimum conduit size shall be ¾-inches.
   3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be ¾-inches unless noted or indicated otherwise.
   4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.

B. The minimum conduit size for flexible metallic conduit for tap connections to individual

light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.

C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.

D. MC, BX and AC cable shall not be used on this project.

E. PVC elbows shall not be used on this project.

F. Intermediate metal conduit (IMC) shall not be used on this project.

2.3 RIGID METAL CONDUIT

A. UL labeled, Schedule 40:
   1. Mild steel pipe, zinc coated inside and out
   2. Aluminum Alloy 6063, T-1 temper
   3. Threaded ends
   4. Insulated bushings

B. Fittings shall meet the same requirements as rigid metal conduits.
   1. UL labeled
   2. Threaded fittings

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. UL labeled, standard weight:
   1. Cold rolled steel tubing, zinc coated inside and out
   2. Aluminum Alloy 6005, 6063. Temper T-1

B. Fittings shall meet the same requirements as EMT conduits.
   1. UL labeled compression fittings only.
   2. Insulated throat connectors
   3. Steel fittings with lock nuts on threaded ends, no snap locks
   4. Set screw and crimp type fittings are not approved
   5. Cast metal fittings are not approved
   6. Uni-couple type connectors are not approved
   7. Split ring, anti-short bushings are not approved

2.5 RTRC CONDUIT FITTINGS AND CONDUIT BODIES

A. UL listed

B. Standard wall thickness sizes ¼-inch through 4-inch

C. Underground medium wall thickness sizes 5 and 6-inch

D. Conduit interface joints above grade, gasket joint below grade

E. Extra heavy wall for above ground and/or UL Class 1 Division 2 and Class 1 Zone 2 applications.

2.6 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H_2O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.

C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.

D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be

matched to the outside diameter of the conduit.

E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.

F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.

G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.

H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).

J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.

K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
   1. Conduit and condulet exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
   2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
   3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
   4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.

N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

2.7 STEEL FLEXIBLE CONDUIT

A. Steel flexible metallic conduit:
   1. Zinc coated inside and out
   2. 18-inches minimum length, 24-inches maximum length

B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
   1. 18 inches minimum length; 6 feet maximum length

C. Liquid tight flexible steel conduit
   1. Type L.A. - Grounded - UL Approved
   2. 18-inches minimum length, 24-inches maximum length

2.8 PVC CONDUIT

A. UL labeled Schedule 40 and Schedule 80

B. PVC fittings and solvent welded joints

C. Acceptable PVC condulet manufacturer: Ipex, Cantex

2.9 CONDULETS AND CONDUIT BODIES

A. UL Labeled
B. Form 85
C. PVC Coated: Form 8
D. LBC Condulets shall be used for size 2 inch and above.
E. LL and LR Condulets shall not be used for 2 inch and above

2.10 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.
B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.
C. Approved Manufacturer:
   1. Portable Pipe Hangers
   2. Eaton B-Line
   3. Miro Industries, Inc.

2.11 ALUMINUM CONDUIT

A. UL Labeled
B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
   1. UL Labeled for use with aluminum conduit.

2.12 STAINLESS STEEL CONDUIT

A. UL Labeled
B. Rigid Stainless Steel:
   1. Type 304 Stainless Steel
   2. Threaded ends
   3. Insulated Bushings
C. EMT:
   1. Type 304 Stainless Steel
   2. Compression Fittings
   3. Insulated Bushings
D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
   1. Type 304 Stainless Steel

2.13 EXTERIOR IN-GRADE PULL BOXES

A. Enclosures, boxes and covers are required to conform to all test provisions of the most current ANSI/SCTE 77 “Specification for Underground Enclosure Integrity” for Tier 22 applications. When multiple “Tiers” are specified the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. All covers are required to have the Tier level rating embossed on the surface. In no assembly can the cover design load exceed the design load of the box. All underground enclosures are to be UL listed as proof that they meet the latest version of the above specification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal:
   1. Tier 22 rated for non-deliberate traffic
   2. Conduit entry knock-outs as required
   3. Bolt down covers with SS self-cleaning “auger” style bolts
   4. Integral or separate bottom
   5. Adjust to grade option if available
   6. Extension as required for specified conduit depth
   7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.

8. If larger than 24x26x24-inches, brace the interior prior to backfilling and compaction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA “Standard of Installation”, concealed where possible.
   1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
   2. Arrange supports to prevent misalignment during wiring installation.
   3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   4. Do not attach conduit to ceiling support wires.
   5. Arrange conduit to maintain head room and present neat appearance.
   6. Maintain 4-inch clearance between conduit and rooftop surfaces.
   7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
   8. Bring conduit to shoulder of fittings; fasten securely.
   9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
   10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
   11. Ground and bond conduit as required.
   12. Identify conduit as required.
   13. Route all conduits above building slab perpendicular or parallel to building lines.
   14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.

B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.

D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.

E. Provide separate raceway systems for each of the following when specified, indicated or required:
   1. 120/208 volt circuits
   2. 277/480 volt circuits
   3. Emergency
      a. Life safety branch
      b. Critical branch
      c. Equipment branch
   4. Voice/Data
   5. Sound reinforcement
   6. Theatrical and Architectural Dimming Controls
   7. MATV/CATV
   8. Security CCTV
   9. Security System
   10. Communications / PA Systems / Sound System Line Input and Speakers

11. Fire Alarm
12. Lighting and Building Management Control Systems

F. Unless shown otherwise, do not install conduit in or below concrete building slabs.

G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.

H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.

I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.

J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.

K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
2. Provide insulated bushing on all rigid conduit terminations.
3. Provide locknuts inside and outside of all boxes and enclosures.
4. Provide threaded type plastic bushing at all boxes and enclosures

L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
2. Do not support from metal roof deck.

M. Completely install each conduit run prior to pulling conductors. All boxes are to be accessible after completion of construction.

N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.

O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.

P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
1. Cable Tension:
   a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
   b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
   c. 1000 lbs. per basket grip.
2. Sidewall pressure: 500 lbs./ft.
3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
   a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
   b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.
   c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet

(150') between pull points.

d. Straight pull: not more than two hundred feet (200') between pull points.

4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.

Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.

R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.

S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.

T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.

U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.

V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.

W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt "wings" are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and

threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.

Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.

Z. Where “LB” condulets are used, 2-inches and larger shall be type “LBD”.

AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.

BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc. They are not to be used in lieu of conduit runs. They shall not be used for wall or roof penetrations unless they are installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.

CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.

DD. “Daisy Chaining” light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.

EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.

FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.

GG. Install minimum size 2 inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

3.2 CONDUITS

A. Conduit above grade indoors:
   1. Concealed Conduits: EMT with set screw fittings
   2. Exposed conduits:
      a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit or x-wall RTRC.
      b. Where subject to physical damage: Rigid metal conduit or x-wall RTRC.
      c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
      d. Damp Locations: Aluminum rigid conduit or x-wall RTRC.
      e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel or x-wall RTRC when installed below 18-inches above finished floor.

B. Conduit installed above grade outdoors:
   1. Galvanized rigid steel or x-wall RTRC for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
   2. Aluminum or x-wall RTRC where not subject to physical damage and where located four feet above finished floor.

C. Conduit where indicated underground:
1. PVC Coated Galvanized rigid steel or RTRC conduit elbows and PVC, RTRC, or PVC coated galvanized steel straight run conduits.
a. PVC conduit and fittings shall be used only for straight horizontal runs and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.
b. Change in direction of conduit runs, either vertical or horizontal, shall be with RTRC or PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.
c. Provide RTRC or PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous RTRC or PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.
d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be RTRC or PVC coated rigid galvanized steel with long radius as follows:
1) Up to 1-inch conduit, minimum 12-inch radius.
2) 1.5-inch conduit, minimum 18-inch radius.
3) 2-inch conduit, minimum 24-inch radius.
4) 2.5-inch conduit, minimum 30-inch radius.
5) 3-inch conduit, minimum 36-inch radius.
6) 3.5 to 6-inch conduit, minimum 48-inch radius.
e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.
f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.
2. Encase all underground conduits in concrete.
a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
b. Provide minimum 3-inch concrete encasement around conduits.
c. Provide conduit spacers for parallel branch/feeder conduits.
d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.

e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.

3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.
4. Provide two “caution” plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.

D. Conduit shown in concrete walls, floor or roof slab:
1. PVC Coated Galvanized Rigid steel.

E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
1. RTRC
2. PVC coated galvanized rigid steel

F. Connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
2. Liquid tight flexible metal conduit for 24-inch maximum length

G. Light fixture whips:
1. Accessible ceilings and open structure: ½-inch flexible steel conduit, length not to exceed 6-feet.
2. Non-accessible ceilings: ½-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture’s integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
3. Dedicated insulated ground wire.

4. Light fixture whips shall not rest on ceiling grid or tile.
5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit shall be kept a minimum of 2 inches clear of roof deck.

H. Conduits at Natatorium or therapeutic pool areas:
1. Underground conduit shall be as specified in this section.
2. Exterior conduits and boxes within 100 feet of exhaust openings shall be x-wall RTRC or PVC coated galvanized rigid steel or stainless steel.
3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.

I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
1. X-wall RTRC
2. Schedule 80 PVC
3. PVC coated galvanized rigid steel conduit and fittings.

J. Conduits in classified hazardous (Classified) locations:
1. Conduit fittings and seals UL listed for the classification

3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
2. Sleeves shall extend 3-inches above the finished floor.

B. Sleeves in concrete or masonry walls shall be RTRC or Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.

C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.

D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.

E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.

F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.

G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

A. Power underground feeder and service entrance shall be of individual conduit encased in concrete. Unless shown otherwise, the type of conduit used shall not be mixed in any one

underground conduit and shall be the size indicated on the drawings. The concrete encasement surrounding the underground conduit shall be rectangular in cross-section, having a minimum concrete thickness of 3-inches, except that conduit for 120V and above shall be separated from control and signal conduits by a minimum concrete thickness of 3-inches. Encasement concrete shall be tinted in red.

B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.

C. Furnish the exact dimensions and location of power underground conduit to be encased in time to prevent delay in the concrete work.

D. Conduit for service entrance underground conduits shall be as indicated on the drawings.

E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes, and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.

B. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.

1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
   a. Non-masonry outlet box: Two 1-inch conduits.
   b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
   c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.

C. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling, and be turned horizontally with plastic bushing at terminations.

D. Conduits for Building Entrance Facilities:

1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X

the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.

3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

3.6 EXTERIOR IN-GRADE PULL BOXES

A. Provide pull boxes where specified and as required.

B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.

C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.7 IDENTIFICATION

A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

SECTION 26 0535
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.

B. Raceways: Refer to related sections.

C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.

D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.

B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.

C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.

D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.

E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.

F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable condulet, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.

G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:

1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a

bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.

2. Where conduit originates from an elevation above the conduit entry, provide a “T” condulet below the enclosure’s bottom elevation. Provide conduit from the condulet up to the enclosure bottom horizontal surface for electrical connection.

H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.

I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.

J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

SECTION 26 0537
ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.

1. Type of Various Locations:
   a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
   b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
   c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
   d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
   e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
   f. Surface: Type FS or FD box with surface cover.
   g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
   h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
   i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.

B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.

C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.

D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.

1. Type for Various Locations:
   a. Minimum Size: 4-inch square, 2-1/8-inches deep.
   b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
   c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners

E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.

F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.

G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.

B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.

C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.

D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.

E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.

F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
K. Provide knockout closures to cap unused knockout holes in boxes.
L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.
N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.
R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
    1. Orange: - 480/277 VAC systems
    2. Light Blue: - 240 VAC three phase delta systems.
    3. Red – All Emergency circuits, regardless of load, and fire alarm system.
    4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
    5. Yellow – Building Management and Control System - BMCS
    6. White - Security and Surveillance equipment circuits
S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example “MSB to Panel HA”). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example “LA2” referring to Panel LA sec. 2 is to be listed as “LA”). Label covers for special applications explaining contents (example “Emerg. Gen. Annunciator controls”, “IDF ground”). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example “Not Used Panel LA”. Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
AA. Use adjustable steel channel fasteners for hung ceiling outlet box.
BB. Do not fasten boxes to ceiling support wires.
CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
DD. Use gang box where more than one device is mounted together. Do not use sectional box.
EE. Use gang box with plaster ring for single device outlets.
FF. Support outlets flush with suspended ceilings to the building structure.
GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.
JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
NN. Bond equipment grounding conductor to all junction and pull boxes.
OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.
B. Install knockout closures in unused box openings.

END OF SECTION

SECTION 26 0540
ELECTRICAL GUTTERS AND WIREWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical gutter work as shown, as specified and as required.

B. Application: The types of electrical gutters required for the project include the following:

1. Electrical wiring gutters
2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.

B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer’s standard lengths, without field cutting or field extensions.

C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.

D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.

E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.

B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.

C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to installation of electrical gutters.

D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical conductivity. Provide equipment grounding conductor.

E. Conductors:

1. Complete gutter and wireway installation before starting the installation of conductors.
2. Provide sufficient space to permit access for installing, splicing, and maintaining the conductors.

F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any gutter or wireway.

END OF SECTION

SECTION 26 0550
FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson

B. 3M (Minnesota Mining Manufacturing)

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 26 0800
ELECTRICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of the Contractor, Owner, CxA and Design Professionals as related to the Division 26 Electrical.

B. Related Sections:

1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical
5. Division 27 – Communications
6. Division 28 – Safety and Security

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTRACT INFORMATION

A. The Owner will contract directly for commissioning services.

1. Commissioning Agent fee will be paid for directly by the Owner.
2. Contractor shall provide coordination with the CxA including but not limited to labor, materials, and testing equipment as required for the CxA as specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment and other items required for Functional Performance Testing includes but not limited to those listed below. Data logging and software required for testing and corrective measures as required by the contract documents shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

A. Ladders and/or lifts and appropriate fall protection as required by Contractor and the CxA.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 26 specifications, including specific contractor provided or furnished items indicated by this Section, shall be provided by the Contractor.

3.2 SUBMITTALS

A. Electrical:

1. Lighting controls and lighting equipment submittals conforming to the contract documents.

3.3 EQUIPMENT START-UP

A. Notification:

1. Contractor shall provide ten Owner business day notice to CxA, Owner and Design Team of start-up dates. Owner business days are defined as the Owner's Construction and Maintenance Operations department's normally scheduled work days, typically Monday through Friday, excluding Federal, State, Local, and Owner scheduled Holidays.

B. Prior to start-up, Contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected and ready for operation. Perform all pre-start inspections and tests as called for in Division 26 and as recommended by the equipment manufacturer.
2. Pre-start requirements of the manufacturer shall include but not limited to the Contractor's completed applicable documentation and completed inspection and check-list.
3. Complete applicable sections of Pre-functional Checklists (PFCs).
4. Coordinate start-up attendance by manufacturer or their authorized representative as required by the specifications and the manufacturer.

C. At start-up, Contractor shall:
1. Supervise the activities of the manufacturer's authorized start-up technician and/or authorized manufacturer's representative.
2. Verify proper voltage, overcurrent protection, phase, phase sequence, and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of contractor personnel familiar with the installation and operation of equipment being commissioned and the equipment manufacturer's personnel in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues and noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action to comply with the Contract Documents and equipment manufacture's installation and operation requirements.

3.4 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. If approved by the Cx as an alternate, contractor may submit alternate versions of the PFC's to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:
1. Electrical.
a. Lighting and lighting controls.

3.5 FUNCTIONAL TESTING

A. General:
1. Contractor shall organize and schedule Contractor Team members to execute the functional testing , which will be directed by CxA.
a. Lighting and lighting controls.

END OF SECTION

SECTION 26 0925
ELECTRICAL CONTACTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric

2.2 CONTACTORS

A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
2. Contacts shall be readily replaceable, self-aligning, silver alloy.
3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.

B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
3. Normally open contactors shall be spring-loaded open and magnetically closed.
4. Contactors for emergency lighting or power shall be normally closed.

C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.

D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.

E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

F. Minimum interrupting rating shall be 35KAIC.

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer’s recommendations.

B. Fuses: Install fuses where coil control power is fed from line side of contactor.

C. Adjustment: Adjust operating mechanisms for free mechanical movement.

D. Coordinate contactor control and operation requirements with the Building Management Control System.
E. Identify each contactor as specified in Section 26 05 00.
F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.
B. Provide mechanically held contactors where control is three-wire, momentary control signal.
C. Provide electrically held contactors where control is two-wire, constant control signal for open or close.
D. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.
E. Provide normally closed contactors for circuits controlled by “emergency power off” or teacher control switches in science classrooms, computer labs, and vocational instructional areas.
F. Provide control contactors and cabling for bi-level or tri-level LED drivers. Bi / tri level control contactors for exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both “ON” and “HIGH” settings. Bi / tri level controls for interior lighting shall be controlled by occupancy sensors and local control switch.

END OF SECTION

SECTION 26 0944
LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Lighting control system and components:
   1. Touch panel controls
   2. Low and line voltage wall stations
   3. Power interfaces
   4. Sensors

1.2 SUMMARY

A. The lighting control system specified in this section shall provide manual lighting control, sensor-based (both occupancy and daylight control when indicated, specified, or required by AHJ.
B. The system shall be capable of turning lighting and plug loads on/off as well as dimming lights (if lighting load is capable and indicated to be dimmed). Dimmers shall be capable of smooth dimming lights to off.
C. All system devices within a group or controlled area shall be networked together, enabling wired or wireless digital communication between devices within that group.
D. The system architecture shall be stand-alone groups (areas) of devices.
E. The system shall not require any centrally hardwired switching equipment.
F. The system shall be capable of wireless, wired, or hybrid wireless/wired communication architectures. All powered devices shall be wired for power. Battery operation shall not be used unless specifically indicated on the drawings, typically due to existing conditions which prohibit wired power sources.
G. The term “occupancy sensor” shall be interchangeable with the term “vacancy sensor” as the control hardware shall be the same device and be capable of either function.

1.3 SUBMITTALS

A. Specification line-by-line compliance review consisting of a marked-up copy of these specifications with contractor comments. Refer to Submittals specification section for additional instructions.
B. Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring details, nomenclature)
C. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
D. Other Diagrams – as needed for special operation or interaction with other system(s)
E. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up and commissioning.
F. Hardware Operation Manuals
G. Other operational descriptions as needed.

1.4 PROJECT CLOSEOUT DOCUMENTATION

A. Provide a factory published manual
   1. Warranty
   2. Technical support contact
   3. Electronic manual on manufacturer’s website for free download
B. Completed Startup/Commissioning Worksheet with Owner’s acceptance and date clearly noted.

1.5 QUALITY ASSURANCE

A. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degrees Fahrenheit (and Celsius) operation.
C. All applicable products must be UL or ETL Listed or other acceptable national testing organization.

1.6 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:
   1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C).
   2. Relative Humidity less than 90% non-condensing.
B. Standard electrical enclosures shall be permanently installed.
C. Equipment shall be protected from dust, debris and moisture.

1.7 WARRANTY

A. Five (5) year manufacturer's warranty parts replacement beginning upon completion of Factory Start-up and Commissioning date as noted on the Owner accepted Startup / Commissioning Worksheet.

1.8 MAINTENANCE & SUSTAINABILITY

A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years available to the end user.
B. Provide free telephone technical support.
C. Spare Parts: Provide minimum of 1 unit up to 5% of each hardware device product used, whichever is greater.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Acuity Brands Lighting, Inc.
   2. Legrand North America, LLC
   3. Eaton Corporation, PLC
   4. Lutron - Athena
   5. US LED

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, UL 924 emergency lighting relays, dimming outputs, manual switch stations, manual dimming stations. Combining one or more of these components into a single device enclosure is be permissible so as to minimize overall device count of system.
B. Lighting control zones shall consist of one or more intelligent lighting control components and fully functional in stand-alone operation.
C. Low voltage devices within a lighting control zone shall be capable of being connected with low voltage cabling in any order.
D. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
E. Power for devices within a lighting control zone shall come from either resident devices already present for that zone. Standalone power supplies are not acceptable.
F. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements.
G. Individual lighting zones requiring or indicated with intelligent room controllers shall be capable of being segmented into several local channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

H. Operating modes shall be utilized only in manners consistent with local energy codes. Where daylight controls are indicated or required the photocell functions noted below shall be incorporated.
   1. Auto-On / Auto-Off (via occupancy sensors)
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
      c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
   2. Manual-On / Auto-Off (also called Semi-Automatic or Vacancy)
      a. Pushing a switch will turn lights on.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   3. Auto On / Predictive Off
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
      c. Pressing the switch will turn the lights off and a short “exit timer” begins. After the timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
   4. Auto ON at 50% or less / Auto Off (Occupancy with dimming)
      a. Operating mode designed specifically IECC compliance using occupancy mode for specific areas.
      b. Zones with occupancy sensors automatically turn lights on to maximum 50-percent (adjustable and programmable to 50-perecent max) when occupant is detected.
      c. Pushing a switch will raise or lower light levels.
      d. Zones with occupancy and/or photocell sensors turn lights off when vacancy or dim accordingly when daylight is detected to maintain desired light level.
      e. Pushing a switch will turn lights off.
   5. Manual-On to Auto-On/Auto-Off
      a. Pushing a switch will turn lights on.
      b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Occupancy sensors:
   1. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
   2. Only passive infrared (PIR) technology, which detects occupant motion, shall be used to initially turn lights on from an off state, thus preventing false on conditions.
   3. Dual technology sensors shall be used. Only where ultrasonic or microphonic technology might create a false occupied state, not allowing the lights to automatically turn off shall PIR only be used. Acceptable dual technology includes PIR/Microphonics technology (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants or PIR/Ultrasonic technology.
   4. Sensors shall include a minimum of one integrated dry contact switching relay, capable of switching 1 amp at 24 VAC/VDC (resistive only) for BAS/BMCS control.

5. Sensors shall be available in multiple lens options which are customized for specific applications.
6. Embedded luminaire sensors shall be capable of both PIR and Dual Technology occupancy detection. Embedded sensors shall have an optional photocell.
7. Ceiling, fixture, recessed, & corner mounted sensors shall be available.
8. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

B. Daylight (photocell and/or dimming) sensors:
1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, luminaire depreciation, or luminaire outages).
4. Combination units that have all features of on/off photocell and dimming sensors may be used
5. Luminaire mounted dimming photocells shall be embedded into luminaire such that only the lens shows on luminaire face.

C. Power (Relay) Packs:
1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system.
2. Power Packs shall accept 120 or 277 VAC, rated for a minimum 16 Amps for any type of lighting load or motor load rated to 1 HP, provide 0-10 VDC dimming control, be plenum rated, and provide Class 2 power to the system.
3. Every Power Pack parameter shall be available and configurable locally.
4. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
5. When required by local code, Power Pack shall install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
6. Secondary Packs shall be available that provide up to 5 Amps of switching and can line voltage dim 120 VAC incandescent/halogen lighting loads.
7. Secondary Packs shall be available that provide up to 5 Amps of switching and can dim line voltage 120/277 VAC magnetic low voltage transformers.
8. Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
9. Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits and control of 0-10 VDC dimming circuit.
10. Secondary Packs shall be available that control louver/damper motors for skylights.
11. Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
12. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.

D. Relay & Dimming Room Controller (Panel)

1. Panel shall incorporate up to 3 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
3. Panel shall provide one 0-10VDC dimming output paired with each relay.
4. Panel shall power itself from an integrated 120/277 VAC supply.
5. Panel shall supply current limited low voltage power to other devices in the same lighting zone.
6. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection.

E. Auxiliary Input / Output (I/O) Devices for enhanced room controls:
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
2. Specific I/O devices shall have a dimming control output that can control 0-10 VDC LED drivers by sinking up to 20 mA of current.
3. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
4. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.
5. Specific I/O devices shall sense state of low voltage outdoor photocells.
6. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
7. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

F. Low Voltage Wall Switches & Dimmers:
1. Devices shall provide toggle on/off switch control.
2. Devices color shall match building standard line voltage wiring device color.
3. Devices with mechanical push-buttons shall provide tactile with LED user feedback.
4. Devices with mechanical push-buttons shall be made available with custom button labeling

G. Graphic Wall Station:
1. Minimum 3.5-inch full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
2. Color shall match building standard for line voltage switching.
3. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
4. Device shall enable user supplied .jpg screen saver image to be uploaded.
5. Surface mount to single-gang recessed switch box.
6. Micro-USB style connector for local computer connectivity.

H. Scene Controllers:
1. Two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Color shall match building standard for line voltage switching.
3. Devices shall provide LED user feedback.
4. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
5. Device shall have LEDs indicating current selection.

2.4 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any field programming is performed.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide the quantity of sensors required for complete and proper coverage to completely cover the controlled areas. Contractor shall verify room coverage and ceiling heights with manufacturer and provide the quantity and type of occupancy sensors as required. Rooms shall have one hundred (100) percent coverage of small motion detection to completely cover the controlled areas to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components, architectural components, or Owner installed equipment which may cause obstructions to sensor coverage.

B. Provide ceiling mounted sensors. Wall mounted sensors shall only be used where ceiling mounted sensors are proven by the manufacturer to be impractical, or if specifically indicated on the drawings.

C. For ceilings up to 12-feet AFF, control equipment shall be mounted above an accessible ceiling. Control equipment shall be wall mounted on 24x24-inch fire resistive 0.75-inch thick plywood back board mounted to the wall above the ceiling. Do not paint fire resistive plywood or obliterate the fire resistive labeling. Locate the control equipment directly above the space/area main entry wall switch station, observing good installation practice and shall be consistent throughout the project. Where the ceiling is over 12-feet, the control equipment shall be located in an adjoining ancillary room/area where the ceiling is 12-feet AFF or lower, typically adjacent to the ancillary room/area above ceiling control equipment location, verify exact location with Owner.

D. Control units used for the security or fire systems shall be powered from the emergency power source as indicated on the drawings. Other control units shall be powered from the lighting circuit, which they control.

E. Refer to other specification sections for line voltage wiring device requirements, including momentary on/off toggle switches used with low voltage sensors.

3.2 INSTALLATION

A. Use lighting control wiring with jacket color that matches Owner’s cable color standards.

B. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

C. The installing electrical contractor shall complete, prior to request of factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed, and confirmed operational.

D. The installing contractor shall, prior to request of factory start up and site commissioning, request an on-site meeting by including the manufacture’s local authorized representative, the Owner and the general contractor, to assist in identification of any open-ended issues, thereby eliminating potential for delays and system commission interruptions.

E. Upon confirmation of progress by local factory representative, the installing electrical contractor shall complete the manufacture’s start up request form(s), including any field changes from the contract documents.

F. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning to the manufacturer’s representative. Drawing shall include all wire routing, room by room device ID’s and locations of all lighting control devices.

G. Install sensors in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

H. Install sensors and switches only in electrical boxes that are clean, free from excess building materials, debris, and similar matter.

I. Install sensors plumb and aligned in the plane of the wall, or ceiling in where they are installed.

J. Install wall occupancy sensor switches in boxes on the strike side of doors as hung. Where more than one switch is in the same location, install switches in a multi gang box with a single cover plate.

K. Provide a cover plate for every switch. Refer to Architectural drawing, elevations, etc. for exact location of wall switches where indicated on the Architectural plans. Coordinate location of all wall switches with other specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts during construction. Mounting heights of all switches shall comply with current Accessibility Standards and local codes.

L. Unless indicated otherwise, circuit relays/switchpacks ahead of local control switches. Source –> relay/switchpack –> local toggle switch(s).

M. Coordinate with BMCS/BAS Contractor for interface of BMCS/BAS System and wiring connections.

N. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices.

3.3 SENSOR TESTING AND ADJUSTMENT

A. At the time of installation, the contractor shall test and adjust each sensor for proper detection of motion appropriate to room usage. The contractor shall follow the testing and adjustment procedures as written in the manufacturer’s installation instructions for each sensor model. Relocate sensors as needed for proper coverage.

B. Prior to testing and adjusting, verify with Owner/Architect the initial settings for each type of area based on its intended function and use.

C. Verify with Owner all adjustable functions of each type of occupancy sensor prior to installation. Set all adjustable functions of each type of occupancy sensor as directed by Owner. Initial settings unless directed by Owner / Architect (some settings may not apply to all sensors):

1. Time delay = 10-miniutes
2. Zero Time Delay = OFF
3. Auto-On = OFF
4. Manual-On = ON
5. Self-Adjust = OFF
6. Disable Self-Adjust = OFF
7. Energy Saver (Dual Level) = ON
8. Manual Override = OFF

D. Bi-level occupancy wall switches shall be initially set with the energy saver feature enabled.

E. Before energizing, check for continuity of circuits, short circuits, and grounding connections. After energizing, check devices to demonstrate proper operation.

F. Operate each wall switch with circuit energized and verify proper operation

3.3 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 and of all occupancy sensors and photocells.

C. 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 set points.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters

D. The electrical contractor shall provide in writing to the manufacturer, General Contractor, Architect, and the Owner with 21 Owner's business days' written notice of the requested system startup and adjustment date.

E. 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.

F. 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.

G. Re-commissioning – After 90 days from full certificate of occupancy, 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.

END OF SECTION

SECTION 26 1217
ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
   1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.

B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards

B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.

C. Metering Standards:
   1. Computational algorithms per IEEE Std 1459-2000
   2. UL 916, UL 61010C-1 CAT III

D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
   1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.

E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.

F. ISO 9000:2000 – International Standards Organization - Quality Management System

G. ISO 14000:2004 – International Standards Organization - Environmental Management System

H. NFPA 70 - National Electrical Code (Latest Edition)

I. NEMA ST20-2014 - Dry-Type Transformers for General Applications

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment

K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.

L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.

M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.

N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. Submit product data including the following:
   1. Copy of ISO 14001:2004 Certification of manufacturing operation.
   2. Copy of ISO 9001:2000 Certification of manufacturing operation.
   3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
   4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
   5. Inrush Current (typical 3 cycle recovery)
   6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)

7. Efficiency Data
   a. No load and full load losses per NEMA ST20
   b. Linear load Efficiency data @ 1/6 load
   c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
   d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
   e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
   a. Meter and CT details including model, accuracy, serial numbers and calibration information.
9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
10. 25 year Product Warranty Certificate

B. Description of manufacturer's factory nonlinear load test program.
1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

1.4 SPECIFICATION COMPLIANCE REVIEW

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a comlete copy with the product data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store and protect products
B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.
C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect

against unfavorable external environment such as rain and snow, during handling.

1.6 WARRANTY

A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

A. Registration to current ISO standard is required.
B. Independent annual audits are conducted.
C. Product shall be manufactured in registered facility
D. ISO 9001:2000 Registered – Quality Management System
E. ISO 14001:2004 Registered – Environmental Management System
   1. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must the product of a manufacturing process that has been independently audited to comply with the ISO 14001:2004 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.
   2. ISO 14001:2004 ensures that a facility has had an independent environmental impact assessment of raw material sourcing and all manufacturing processes, and has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

A. Powersmiths E-Saver OPAL
B. Power Quality International (EY e-Rated)
C. Mirus - ULLTRA

2.2 TRANSFORMER SPECIFICATION

A. Minimum UL Listed and Labeled K-Rating: K7
B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.
C. Insulation System:
   1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest environmental impact, long term reliability and long life expectancy
      a. Class: 220 degrees C
      b. Impregnate Properties for low emissions during manufacturing, highest reliability and life expectancy
      c. Epoxy co-polymer
      d. VOC: less than 1.65 lbs/gal (low emissions during manufacturing)
      e. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
      f. Chemical Resistance: Must have documented excellent performance rating by supplier
      g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress,

overvoltage tolerance)

h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life

D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient

E. Noise levels:
1. 3dB Below NEMA ST-20
2. Production Test every unit. Data to be available upon request.

F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431, April 18, 2013, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers: Final Rule which takes effect January 1, 2016, and comply with the table of maximum no Load Loses, efficiency requirements at 1/6 load, efficiency at 35% load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-rating load profile.

G. Maximum losses and minimum efficiency under linear load conditions per Table 1.

Table 1
Max and Min Values for Losses and Efficiency for “High Efficiency” Transformers
Under K1 Linear and Specified K-Rating Nonlinear Loading

kVA Rating	No Load	16.5% Load				25% Load				35% Load			
		K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
	Max Loss (kW)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.

I. Impedance: Between 3.0% and 6.0% unless otherwise noted.

J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise

K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors.

Provide manufacturer's standard paint finish color indoors.

L. Transformer Options:
1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.

B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.

C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.

D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.

E. Check for damage and loose connections.

F. Set the transformer plumb and level.

G. Provide Seismic restraints where required.

H. Coordinate all work in this Section with that in other sections.

I. Verify all dimensions in the field.

J. Adjust transformer secondary voltages to provide the required voltage at the loads.

3.2 TESTING

A. Insulation Tests: Before energizing, check transformer windings for continuity.

B. Winding Current: During initial no-load energizing, check current in each primary winding.

C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings.

D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.

E. Performance Validation: To ensure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.

F. Identify non-compliant products to the engineer and replace at no cost to the Owner.

G. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION

SECTION 26 1913
COMBINATION MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Motor controller work as required, scheduled and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D
B. ABB-General Electric Co.

2.2 MOTOR CONTROLLERS

A. General: Combination motor controllers shall consist of an integrally mounted, thermal magnetic or magnetic only circuit breaker disconnect or fused disconnect switch as specified in Section 26 24 25. Magnetic, full voltage non-reversing (FVNR) or two speed controller as required, in a heavy duty type, dead front enclosure, surface-mounted; size and number of poles as required. Controllers shall be constructed and tested in accordance with NEMA Standards. Refer to Division 23 for Variable Frequency Inverter furnished by Division 23, installed by Division 26. Minimum controller size shall be NEMA Size 1.

B. Contacts: Magnetic controller contacts shall be silver alloy, and not require any filing, dressing, or cleaning for the life of the controller.

C. Operating Coils: Operating coils shall be 120V, pressure molded and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. Design controller so that when a coil fails due to over voltage, the controller shall open, and not freeze in the closed position.

D. Overload Relays: Controllers shall have manual-reset, trip-free, solid state, overload relays in each phase conductor. Three phase FVNR controllers shall have three overload relays. Single-phase FVNR controllers shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic controllers shall have overload relays for all six ungrounded conductors. Overload relays shall not be field-convertible from manual to automatic reset. Provide reset button located in front cover to reset all overload relays.

E. LED Pilot Lights: Provide 30.5mm run and stop pilot lights for all motor controllers. Furnish additional pilot lights for motor controllers as shown. Provide FAST and SLOW pilot lights for two-speed controllers. Pilot lights shall be mounted in the controller enclosure cover. Pilot lights shall be operated from an interlock on the motor controllers, and not be wired across the operating coil.

Green - Stop
Red - Run
Yellow - Slow
Blue - Fast

F. Controls: Controllers shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed controllers. Two-speed controllers shall have deceleration relays between fast and slow speeds. Coordinate motor controller controls with the requirements of Division 23. Motor controller controls shall be mounted in the controller enclosure cover. Control switches shall be un-keyed rotary switches.

G. Control Power: A single phase control power transformer shall be included with each controller for 120V control power. The primary shall be connected to the line side of the motor controller through two fuses; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals is not located above the transformer.

H. Auxiliary Contacts: Each controller shall have two normally open and two normally closed nonconvertible auxiliary contact in addition to the number of contacts required for the holding interlock and control wiring. One or more additional auxiliary contacts can be field installed

without removing existing wiring, or removing the controller from its enclosure.

I. Phase Failure Monitors: Provide a 3-phase failure monitor for each motor controller. Monitor on any or all phases, for phase reversal from A-B-C sequence, under/over voltage, and phase failure. Provide adjustable relay for trip range. Provide automatic reset upon restoration of power to all phases. Where solid state overload relays provide this specified requirement, separate phase failure relays may be omitted.

J. Unit Wiring: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for: connection of power supply conductors to switch line side terminals; motor leads to the controller load side terminals; and control conductors to holding coil terminals.

K. Enclosure:
   1. Motor Controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
   2. Motor Controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

L. Minimum interrupting rating shall be 35KAIC.

2.3 MANUAL MOTOR CONTROLLERS

A. General: Manual motor controllers shall consist of an integral controller and overload protection in a common enclosure, surface mounted. Size and number of poles shall be as shown and required with pilot light.

B. Manual Motor Controller: Manual motor controller with overload protection, 1 HP maximum, 115 or 230V.

C. Enclosures:
   1. Manual motor controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
   2. Manual motor controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

D. Disconnect Switch: For self-protected motors where one pole toggle motor control switch is allowed, the switch shall be horsepower rated and as specified for toggle switches in Section 26 27 73.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR CONTROLLERS

A. General: Install combination motor controllers where required or indicated and in accordance with the manufacturer's written instructions, requirements of the NEC and NECA Standard of Installation, and industry practices. Do not install motor controllers above ceilings. Do not install motor controllers on roofs.

B. Overloads: Install overload relays with manual reset in each phase of motor controller. Overload adjustable settings shall be based on actual motor nameplate full load amps. Field verify nameplate full load amps and adjust all relay settings accordingly.
   1. Set overcurrent at motor service factor x motor nameplate FLA
   2. Set high voltage trip to 8.3 percent above nominal voltage
   3. Set undercurrent trip to four automatic restarts
   4. Set all other trips to zero auto restarts
   5. Phase Failure Relay: Adjust phase failure relay to 10 percent over voltage and 10 percent under voltage.

C. Coordination: Motor controllers shall be provided to coordinate with motors furnished by Division 23. Motor controller controls shall be provided to coordinate with controls specified in Division 23.

D. Supports: Provide individual and combination motor controllers with galvanized angle or other suitable supports if mounting on wall or other rigid surface is impractical. Controllers shall not be supported by conduit alone. Where motor controllers are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere

with any required access areas. Manual motor controllers shall be installed plumb and aligned in the plane of the wall where they are installed.

E. Identify each motor controller as specified in Section 26 05 00.

F. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.

3.2 TESTING

A. Provide the field services of the manufacturer to provide initial programming of all variable functions, start-up and commissioning of each motor controller.

B. Pre-Energization Check: Check motor controllers for continuous circuits and short circuits.

C. Post Hook-Up Test: After wire and cable hook-ups, energize motor controller to show it functions as specified.

D. Provide thermal infrared scan of the combination motor controllers rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 2414
TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Switchboard work to existing switchboards 600 volts or less as shown, scheduled, indicated, and specified.

B. Types: Switchboard work for the project includes power distribution switchboards.

1.2 QUALITY ASSURANCE

A. Original Manufacturer’s Installation and Maintenance Instructions

B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

A. Indicate Original Manufacturer’s Installation and Maintenance Instructions for testing, exercising, cleaning, and lubrication where available.

B. Include electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time current curves of all new equipment and components.

C. Original Manufacturer’s Inspection Report

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Replacement parts shall be manufactured by Original Equipment Manufacturer, (OEM) when available. When OEM parts are not available, third party, UL recognized, manufactured parts shall be used. Provide written confirmation on Manufacturer’s letterhead indicating OEM parts are not available.

2.2 MATERIALS AND COMPONENTS

A. Except as otherwise indicated, provide switchboard manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended, and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS-NEW SWITCHBOARD SECTIONS AND/OR ACCESSORIES

A. New Indicating Instruments where indicated: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:

1. Voltmeter, phase to phase and phase to ground or neutral.
2. Current, per phase RMS and 3 phase coverage.
3. Demand current per phase.
4. Power factor per phase and 3 phase average.
5. Real power, 3 phase total.
6. Reactive power, 3 phase total.
7. Apparent power, 3 phase total.
8. Frequency.
9. Average demand real power.
10. Adjustable demand interval (5 to 60 minutes).
11. Nonvolatile memory.
12. Password protected set-up and reset.
13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
14. Full scale readouts with the following accuracy:
    a. Current and voltage measurement +/-0.1%

b.	Power and energy	+/-0.2%
c.	Frequency	+/-0.5%
d.	Power Factor	+/-1.0%
e.	Data update time	0.5 seconds(4 wire)

15. Metering Output.
    a. Pulse output based on kWh, kvarh, or kVAh.
    b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
16. Monitoring:
    a. Harmonic analysis through 63rd with THD and TIF.
    b. Event recorder.
    c. Waveform capture.
    d. Data logger.
    e. Triggered trace memory.
17. Communication:
    a. Front port and dual rear mounted RS485 ports.
    b. BACnet protocol (coordinate with BMCS contractor).
    c. Mini RTU: digital 4 in/4 out.
    d. Analog 1 in/4 out.
    e. Local/remote display of all values.
18. Software:
    a. Windows based software shall be provided to enable setpoint programming.

B. New Feeder and Branch Protective Devices where indicated or required, greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
    a. Adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
    b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
    c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
2. Fusible switches:
    a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    b. Fused switches 600 Amps and below, equipped for class J fuses.
    c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
    d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

C. Feeder and Branch Protective Devices 1,200 Amps and below where indicated or required shall be group mounted:
1. Molded case circuit breakers:
    a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
    b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
    c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy

Reducing Maintenance System switch with local status indicator (ERMS).

2. Fusible switches:
   a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
   b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
   c. 600 Amps and below equipped for Class J fuses.
   d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
   e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

PART 3 - EXECUTION

3.1 INSTALLATION, MAINTENANCE, AND MODIFICATION OF SWITCHBOARDS

A. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards. Comply with Original Manufacture's Operation and Maintenance Instructions for testing and periodic maintenance.

B. Torque all existing and new bus connections and tighten mechanical fasteners to manufacturer's specifications.

C. Install fuses, of ratings shown, in each new or modified fused switch.

D. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as directed by the OEM for coordination with downstream overcurrent devices.

E. Existing Indicating Instruments: Test and calibrate to original manufacturer's specifications. Replace batteries in existing digital instruments where batteries are required. Replace defective indicating instruments with new digital instruments. Provide new digital indicating instruments where indicated on the drawings.

F. Cleaning: Vacuum the interior of the existing switchboard enclosures of all dust and foreign matter. Clean all existing switch contacts according to manufacturer's instructions.

G. Lubrication: Lubricate all existing exposed switch contacts, pivot points and bearings according to manufacturer's instructions.

H. Remove any existing circuit breakers or fusible switches that are not functional or not suitable to be reused as "spares".

I. Provide filler plates where required.

J. Existing switchboards which indicate rust or corrosion shall be repainted; paint indoor switchboards with ALKYD enamel coat, and outdoor switchboards with epoxy enamel coat to match existing color. Do not paint over labels or listings.

K. Mimic bus: Update the existing mimic bus or provide new mimic bus to indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips or match exiting material and color format, fastened flat against the panel face with screws.

3.2 TESTING

A. Provide the services of the Original Manufacturer's Field Services personnel for initial testing at no additional cost to the Owner. The Original Manufacturer's Field Services personnel shall provide at minimum, a visual inspection of the existing switchboards and shall provide a written report on the Original Manufacturer's letter head with recommendations regarding the existing condition and recommendations to further testing, maintenance, and in regard to the specified modifications of the existing

switchboard. The report shall include any deficiencies of the existing switchboard in relation to each component's intended function. In addition, provide deficiencies of the existing switchboard with regard to the current National Electrical Code. Provide the written report to the Architect within 14 days of notice to proceed and prior to any demolition or construction. All other testing, maintenance, and modifications shall be provided by the Contractor as specified at no additional cost to the Owner.

B. Pre-Energization Checks: Before energizing, check switchboards for continuous of circuits and for short circuits. Test existing Bolted Pressure Switches according to Original Manufacture's Instructions.

C. Switchboard Insulation Resistance Test: Each switchboard bus shall be insulation resistance tested after installation and modification is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.

D. Ground Fault Protection System Test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50 percent of the largest overcurrent device rating in the switchboard. Ground fault setting shall not exceed 1200 amperes.

E. Provide thermal infrared scan of the existing switchboard under full load prior to testing/maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

END OF SECTION

SECTION 26 2416
PANELBOARDS AND ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D
B. ABB-General Electric Co.

2.2 MATERIALS AND COMPONENTS

A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.
B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.
D. Main circuit breakers and feeder / branch circuit breakers:
    1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
    2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
    3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
    4. Provide permanent lock-off device where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
    5. General requirements:
        a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
        b. Two and three pole breakers shall have internal common trips.
        c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution

panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.

d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.

e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).

f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.

g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.

h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).

E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.

F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.

G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.

H. Panelboard Enclosures:

1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner’s standard key system; coordinate with Owner.
2. All NEMA 1 enclosure panelboards shall be hinged “door-in-door” type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not used third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.

7. Enclosure shall be for recessed or surface mounting as shown or as required.
8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.

B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.

C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.

D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

E. Fuses: Install fuses, of the ratings and class shown.

F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.

G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.

H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as “not used” and include panel identification.
   1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.
   2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.

I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.

J. Circuit breakers and conductors installed for SPD devices shall be located at the top or bottom of the panelboard in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.

K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.

L. Install panels so that breaker number 1 is the top left breaker.

M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row

unless all other rows are full.

N. Label breaker mounting space with stick-on number labels.

O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

3.2 TESTING

A. Before energizing, energization, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.

END OF SECTION

SECTION 26 2425
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.

B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horse power served.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Switch Mechanism:

1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

A. Overcurrent protective devices 1,200 Amps and below:

1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
2. Molded case circuit breakers:
   a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.

b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

3. Fusible switches:
a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
c. 600 Amps and below equipped for Class J fuses.
d. 601 Amps and above shall be equipped for Class R or L fuses.
e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.

1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
2. The ground fault system shall be factory-tested before shipment as specified:
a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install safety and disconnect switches where required or indicated, in

accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.

B. Location: Provide safety switches within 50’ and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).

C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.

D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.

E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.

F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: “WARNING” (1/2 Inch Letters). “TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE.” (1/4 inch letters).

G. Provide disconnect switch for electric duct heaters.

H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building’s grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.

3.2 TESTING

A. General: Before energizing, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 2430
FUSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Fuse work as shown and scheduled, and as specified.

B. Types: Fuses required for the project include the following:

1. 250 volt current limiting fuses
2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.

B. Types:

1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.

B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION

SECTION 26 2773
LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

A. UL Label: Wiring devices shall be UL labeled.
B. NEMA Standard WD1 and WD6.
C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.
B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277-Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
C. Submit manufacturer's product data sheet for each style of device and plate on the project.
D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toggle switches, straight blade and twist lock devices, interior cover plates:
   1. Leviton
   2. Hubbell
   3. Pass and Seymour
   4. Eaton
B. Dimming
   1. Leviton
   2. Lutron

2.2 WIRING DEVICE COLOR

A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

2.3 RECEPTACLES

A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, NEMA indicated, (X=color designation).
   1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
   2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
   3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
   4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
   5. 20A, 125V plug load control, split circuit marked for “controlled”, tamper resistant: Leviton #TDR20-S1G
   6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX

. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
   1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
   2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.

C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
   1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
   2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (orange)
   3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
   4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX

D. USB 2-port charger / tamper-resistant with 125-Volt receptacles:
   1. USB type A/C, 1 type A and 1 type C port, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5833-HGX
   2. USB A, 2 type A ports, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5832-HGX

E. USB 4-port charger:
   1. USB type A+C, 2 type A ports and 2 type C ports. 5.0A 5.0VDC charging. Hubbell #USB4ACX.
   2. USB type A, 4 type A ports. 5.0A 5.0VDC charging. Hubbell #USB4X.

2.4 WALL SWITCHES

A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
   1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
   2. Double pole 120/277V, 20A switch: Leviton #1222-2X
   3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
   4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
   5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
   6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G

B. Rotary key operated switch (verify manufacturer and keying with Owner prior to construction).
   1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
   2. Two-pole, 120/277, 20A key operated, Leviton #1222-2KL.
   3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL

4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
5. Key switches shall be all keyed alike to match the Owner's standard key system. Leviton #WS-35 or as otherwise directed by Owner.

2.5 WALL DIMMERS

A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
   1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
   2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
   3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
   4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
   5. Color change kit as required.

2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GFBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: DRINKING FOUNTAIN GFCI).

2.7 INTERIOR WALL COVER PLATES AND FASTENERS

A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).
B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
   1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
   2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word "EMERGENCY".
   3. Text orientation shall be upright, readable from left to right when cover plate is installed.
   4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
   5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream ("EDF" for drinking fountains, "RM RECEPTS", "HOOD RECEPTS", "VENDING", "REFRIG", etc.) For other loads, Owner/Architect shall determine name plate wording.

2.8 EXTERIOR COVER PLATES

A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
   1. Vertical mount receptacle: #CKSUV
   2. Horizontal mount receptacle: #CKMU
   3. Two-gang: #2CKU
   4. 30-60 Amp Devices: #CKLSUV

2.9 CORD REELS AND DROP CORDS

A. Cord Reels:
   1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.

2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.

B. Drop cord receptacles:
1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

2.10 FIRST RESPONDER EMERGENCY REMOTE POWER OFF (FREPO) STATION

A. Knox Company Remote Power Rapid Access 4500 Series Shutdown Station
1. Recessed mount for public spaces and new construction, surface mount for when mounted to equipment or existing construction.
2. Single lock keyed for local Fire Department/AHJ, verify configuration and keying with Knox Company.
3. Red Finish
4. Tamper alert for integration with building security system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
1. Key switches and keys shall be as specified and also as approved by Owner.
2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.

B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.

D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.

E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.

F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.

G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.

H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.

I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.

J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.

K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)

L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.

M. Do not share neutral conductor on load side of dimming switches.

N. Install receptacles with grounding pole down, except in any of the following conditions where the grounding pole shall be installed in the up position: healthcare occupancies, if required by local AHJ, if required by Owner's construction standards or if directed by Owner or Architect. If installed horizontally, install with neutral pole on top.

O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

P. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.

Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.

R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.

S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.

T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

3.2 GROUND FAULT PROTECTION FOR PERSONELL

A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.

B. GFCI personal protection locations include but are not limited to the following:

1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-

Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.

2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.
3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
   a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
   b. Bathrooms/toilets/restrooms
   c. Janitors/custodial closets and mop sinks.
   d. Laundry areas
   e. Parking structures, service garages, garages and accessory buildings
   f. Basements, crawl spaces (including 120-Volt lighting)
   g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
   h. Indoor damp and wet locations
   i. Locker rooms
   j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
   k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
   l. Receptacles serving dwelling unit kitchen counter tops
   m. Vending machines
   n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits, hoist ways, well ways or those mounted on the cars of elevators and dumb waiters.
   o. Electric vehicle charging equipment.
   p. All receptacles serving kitchen or food preparation counter tops.
   q. Automotive vacuum machines
   r. Drinking water fountains/coolers and bottle fill stations
   s. Corded high-pressure spray washing machines
   t. Tire inflation machines
   u. Dish washers
   v. Receptacles at end of cord reels or drop cords.
   w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes shore power that requires GFPE).
   x. Central plant, mechanical rooms and electrical rooms
   y. Wood, metal, or other material fabrication or vocational training shops.
   z. Receptacles that serve educational science and science prep room counter tops.

C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.

D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.

E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.

3.3 FIRST RESPONDER REMOTE EMERGENCY POWER OFF (FREPO) STATION

A. Provide Knox Company first responder remote emergency power off (FREPO) stations as indicated and/or where required by local AHJ. Mounting locations shall be as directed by the local AHJ and exact locations coordinated with the Architect. FREPOs shall be circuited only to shunt trip or shut-down control circuiting. FREPOs shall be recessed mounted in public locations and in all new construction when attached to building construction. Provide surface mount FREPOs when mounted to equipment or existing construction.

B. Integrate the FREPOs to shut-down the building non-emergency and non-legally required power sources which include the main electrical utility service disconnect circuit breaker(s), other than non-life safety or non-legally required distribution scale UPS equipment, and non-life safety or non-legally required local power generation equipment.

C. Provide FREPOs for fire pump, life safety, and legally required electrical generation equipment only when required by the AHJ. When required by the AHJ, fire pump, life safety, and legally required power generation and/or stored energy power supply equipment shall each have separate dedicated FREPOs that shut down only their associated power generation/stored energy equipment. FREPOs for emergency, and legally required systems shall have minimal 25-foot physical separation from the building main utility service FREPOs and clearly labeled with the equipment that they will shut down. FREPOs for fire pumps shall have minimal 25-foot physical separation from the any other FREPOs and from the building main utility service disconnect and clearly labeled with the equipment that it will shut down.

D. Integrate the FREPOs tamper switch with the building security or building management control system (BMCS) as directed by Owner.

3.4 TESTING

A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.

B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.

C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.

D. Operate each wall switch with circuit energized and verify proper operation.

END OF SECTION

SECTION 26 4300
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5th Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.

B. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
   1. UL 1449 Fifth Edition
   2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
   4. IEEE 1100 Emerald Book.
   5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
   6. UL 1283 – Electromagnetic Interference Filters

B. When requested for verification, provide copies of the following:
   1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
   2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.

B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.

C. Copies of Manufacturer’s catalog data, technical information and specifications on equipment.

D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 5th Edition and UL 1283.

F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date

of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
   1. Recessed mount panelboard extension with brushed stainless-steel front:
      a. ACT Communications:471- ###V-050-SS-F-PB flush series.
      b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
      c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
      d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
   2. Branch panelboard surface mounted:
      a. ACT Communications 455 series.
      b. ABB Current Technology CG3 60 series.
      c. SSI Surge Suppression, Inc. CSMx12 series.
      d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C

B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
   1. ACT Communications 471 series.
   2. ABB Current Technology CGP3 125 series.
   3. SSI Surge Suppression, Inc. CSMx24 series.
   4. SST Southern Tier Technologies T45-VVVV-120A series

C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
   1. ACT Communications 471 x200 series.
   2. ABB Current Technology TG3 200 series.
   3. SSI Surge Suppression, Inc. CHLxM series.
   4. SST Southern Tier Technologies T45-VVVV-200A series

D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
   1. ACT Communications 471 x200 SEL series.
   2. ABB Current Technology SEL3 200 series.

The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.

B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.

C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
   1. 14 dB from 10 kHz to 1 MHz.

E. Each Unit shall provide the following features:
   1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
   2. Field testable while installed.
   3. High performance interconnecting cable.
   4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
   5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA
   6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
   7. The unit shall be listed as a Type 2 SPD per UL1449.
   8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

2.3 POWER CABLES FOR CONNECTION

A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be

high performance interconnect system “Low Z Cable” cables with Ultra Low impedance characteristics at 10kHz and above.

B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.

B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.

C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.

D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer’s recommendations shall prevail over the information given in the plans and specifications.

E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
   1. Service entrance rated 1,201 Amps and above.

B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
   1. Service entrance rated 801 – 1,200 Amps.
   2. Switchboards located outside.

C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 401 - 800 Amps.
   2. Panelboards above 600 Amps.
   3. Motor control centers.
   4. Non-service entrance switchboards.

D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 400 Amps and below.
   2. Panelboards 600 Amps and below.

3.3 TESTING

A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
   1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.

2. Verify overcurrent device rating.
2. Verify all wiring connections and installation conforms to manufacturer's recommendations.
3. Record information for each product installed and include in O&M Manual

B. A copy of the Factory diagnostic test report and written approval of the installation shall be included with the Electrical Operating and Maintenance Manual. The Contractor shall make all adjustments, changes, corrections, etc. as required by the Factory Trained Representative so that the installation follows the manufacturer's installation and operation instructions without additional charge to the Owner.

END OF SECTION

SECTION 26 5113
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Lighting fixture work is as shown, scheduled and specified.

B. Applications: The applications of lighting fixtures required for the project include the following:

1. General lighting
2. Emergency lighting
3. Outdoor area lighting

1.2 QUALITY ASSURANCE

A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.

B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.

C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.

B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture.

1. Light fixtures:
   General Electric
   Acuity
   Phillips
   US LED
2. LED Drivers:
   Philips
   Osram Optotronic
   Eldo LED
3. Emergency Battery Packs with self-testing drivers/inverters:
   Bodine
   Chloride
   Lithonia
   Dual Lite
   IOTA
4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
   Bodine
5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:

Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.

B. Fixture Types:

1. General:
   a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
   b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
   c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
   d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
   e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
   f. Warranty: 2x2 and 2x4 lay-in light fixtures: 5-year fixture warranty for fixture, driver, and light engine. All other light fixtures: 5-year replacement warranty for fixture, driver, and light engine.
   g. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
   h. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
   i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor
   j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
3. LED Exit Signs: The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
   a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafetoriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.

C. LED drivers:

1. NEMA 410 compliant for in-rush current.
2. Starting Temperature: -40˚ F [-40˚ C].
3. Input Voltage: 120 to 480 (±10%) V.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less

than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.

E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.

F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
2. Bodine BSL310-SI Series for field installation
3. Bodine ELI-S Series for line voltage sine wave inverter field installation

G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.

H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
2. Compatible with 0-10 Volt dimmer switches
3. UL 924
4. Minimum 3-year warranty
5. Integral or remove test switch.

I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
2. 20 Amp ballast/driver load
3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.

B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.

C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.

E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner’s designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.

F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafetoriums and kitchens.

G. Provide exit sign directional arrows as required. Provide a minimum of two and a

maximum of 10% spare exit signs to be installed as directed by Architect.

H. Install in accordance with manufacturers instructions.

I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.

J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.

K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.

M. Install recessed luminaires to permit removal from below.

N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

O. Install wall-mounted luminaires at height as directed by Architect.

P. Install accessories furnished with each luminary.

Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.

R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.

S. Bond products and metal accessories to branch circuit equipment grounding conductor.

T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.

U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.

V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.

W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.

X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Where no building management system is provided or specified, provide time clock switches, photocells, photosensors as specified, and required by the local energy codes.

Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.

Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.

AA. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

BB. Hardware for surface mounting fixtures to suspended ceilings:

1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by

special clips designed for the purpose, provided they lock into place and require simple tools for removal.

2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Lighting Fixture Supports for aluminum canopies:

1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.

B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.

C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

SECTION 27 0100
OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (USB Flash Drive or some type of pre-approved solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer’s operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system’s final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant’s stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System’s O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:

1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant’s stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
12. Schedule of Handsets and other Peripheral Devices, Etc.
13. Schedule of Cable, Jacks, Outlets, Etc.
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules
16. Other required operating and maintenance information that are complete.
17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project’s Technology Consultant.

1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project’s Technology Consultant shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:

1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
2. Minimum ring size: 1"; Maximum ring size: 3".
3. When multiple binders are used, correlate the data into related groupings.
4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11"
   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 flyleaf 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.

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 / normal operating instructions
      2) Regulation, control, stopping, shut down and emergency instructions
      3) 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. Manufacturer's printed operating and maintenance instructions.
   e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
   f. Complete equipment field accessible wiring diagrams
   g. Each Contractor's coordination drawings
   h. 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 27.
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.

END OF SECTION

SECTION 27 0500
COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.

B. Applicable provisions of this section apply to all sections of Division 27, Communications.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.

1. Division 26 in its entirety.
2. Division 27 in its entirety.
3. Division 28 in its entirety.

D. The entire drawing and specification package apply to the work specified in the communication 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.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with current and applicable Codes, Standards, Rules, Ordinances, Regulations, and Best Practices (both published and best practices) 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 (including those not specifically listed in this Specification). Applicable Codes and Standards shall consist of, but not be limited to the following:

1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*

17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

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 a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.

C. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans, and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
   a. Licenses, as applicable to the system being installed
   b. Manufacturer's Certifications
      1) Firm Certification
      2) Installer Certification
      3) Programmer's Certification
      4) System Designer Certification.

1.5 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 Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

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 Consultant in writing, shall be performed or furnished. In the case that 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. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on 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.

F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.

H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project’s consultant.

I. 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 project’s consultant 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.

J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer’s shop drawings and product data submittals shall represent a complete system and documents accepted by the project’s consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project’s Technology Consultant and the Owner.

1.6 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, ordinances, and standards; 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 closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. 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 Consultant. The Consultant 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.

E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3” beyond the finished surface. In pipe chases, they shall extend 8” inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio.1/2 inch greater than outside diameter of the conduit.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final connections to all communications equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or

imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

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.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television

CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television *(A.K.A. Main Antenna Television)*
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nanometer
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet *(Now referred to as TR)*
T.O.	Telecommunications Outlet
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to workstations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems,

Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.16 QUALITY ASSURANCE

A. Equipment Standards:
   1. System and all components shall be brand new stock from manufacturer.
   2. All electronics shall be 100% solid state.
   3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
   At the time of Proposal, the Contractor shall:
   1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
   2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
   3. Hold all legally required state registrations to meet local requirements for submittal drawings.
   4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
   5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 01 and the following.

B. Requirements:
   1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
   2. Submit proof that all system components and cables are U.L. Listed.
   3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
   4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
   5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications

exist.

6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day’s notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under-slab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 or later / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.

1. 3 sets of electronic AutoCAD (2014 dwg or later) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
3. Three sets of blue or black-line prints of each contract as-built drawing.

C. 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 conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground communications raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all communications equipment in and outside of the building.
11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.26 OPERATING TESTS

A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections.

Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.30 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 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.

2.3 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.

2.4 MANUFACTURE'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper Communication 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 Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, 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 Consultant.

2.5 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.

2.6 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.

B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.

C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

A. All materials required for the installation of the Communication 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 installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. Ground busses shall be provided in each any room with communication equipment.

J. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

K. Communications grounding system shall be a single point grounding from the building entrance electrical ground to each Communications room.

L. 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 communications grounding system. The conductors shall be a # 6awg solid with a green jacket

M. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

N. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

O. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is

necessary as specified by the Owner / Architect.

P. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

Q. The installation shall be performed in a professional manner.

R. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

S. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

T. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

U. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where

necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
    a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “IDF(FCR) XXYY –served from MDF (BCR) XXGG).
3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
5. Communication hardware located above accessible ceilings: Provide ½-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. “A/V-EQ”.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull

boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the systems and with the project.

C. Time to be allocated for instructions.
   The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include training as specified per system specification,
   1. Minimum of four (4) hours dedicated instructor time
   2. 2-hour sessions on different, non-consecutive days
   3. Additional instruction time for specific systems as specified in other Sections.

D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

H. Demonstrate equipment functions (both individually and as part of the total integrated system).

I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

K. 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, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

L. Provide a copy of the report and the certificate in an appropriately tabbed section of each

Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this 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 shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.

3.13 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

A. 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.

B. 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 Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant 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 no additional cost to the Owner or the Consultant.

C. 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.

D. 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 Consultant.

3.15 EXISTING SYSTEM TESTING

A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 27 umbrellas, as identified in the Division 27 of the Construction Specifications Institute (CSI) current Master Format . Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.

B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.

C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.

D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect’s judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer’s factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
B. All materials shall be neat, clean and unmarred, and parts securely attached.
C. All extra material as specified shall be delivered and stored at the premises as directed.
D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
   1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
   2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
   3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.
C. Testing:
   1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
   2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
   3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
D. As-Built Drawings:
   1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
   2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However,

before this testing can begin the following must have received and reviewed by the Owner.

1. System Operations and Maintenance Manuals
2. System Test Reports
3. As-Built Drawings

3.19 FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements

B. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 27 0507
COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data

D. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
   1. Actual technology equipment and components to be furnished.
   2. NEC working space and NEC access to NEC working space.
   3. Relationship to other equipment and components and openings, doors and obstructions
   4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.
B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents
C. Coordinate submittals with requirements of the work and of the Contract Documents.
D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes
I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
   2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date

2. Project title and number
3. Contractor's name, address and telephone number
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
a. Contractor
b. Subcontractor
c. Supplier
d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if

no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
   2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
   1. Structural Cabling
   2. Communications System
   3. Sound Reinforcement System
   4. CATV System

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION

SECTION 27 0509
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.
B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
    1. Field conditions.
    2. Condition of installation.
    3. Quality of workmanship.
    4. Start-up of equipment.
    5. Testing and adjusting of equipment.
B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 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 where possible.
D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
    1. Rough-in

2. Finish with all appurtenances in place
3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 27 0510
FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smoke stop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson.

B. 3M (Minnesota Mining Manufacturing).

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 27 0550
TELECOMMUNICATIONS GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials tools and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination and labeling of ground and bonding infrastructure as described on the drawings and/or required by these specifications.

1.2 REFERENCES

A. IEEE C2-2007 National Electrical Safety Code.
B. ANSI/TIA-07-B-2011 Commercial Building Grounding and Bonding Requirements for Telecommunications.
C. NFPA 70™-2011 National Electrical Code
D. NFPA 70E*-2004 Standard for Electrical Safely in the Workplace
E. ANSI/NECA/BICSI-607-2011 Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
F. UL 467 Standard for Grounding and Bonding Equipment.

1.3 QUALIFICATIONS

A. Products specified in this Section shall be manufactured by a company with a minimum of three years' documented experience specializing in manufacturing such products.

1.4 DEFINITIONS

A. Backbone: A facility (e.g. pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
B. Bonding: The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.
C. Common Bonding Network (CBN): The principal means for effecting bonding and grounding inside a telecommunication building. It is the set of metallic components that are intentionally or incidentally interconnected to form the principal bonding network (BN) in a building. These components include structural steel or reinforcing rods, plumbing, alternating current (ac) power conduit, ac equipment grounding conductors (ACEGs), cable racks, and bonding conductors. The CBN always has a mesh topology and is connected to the grounding electrode system.
D. EMI (Electromagnetic Interference): The interference in signal transmission or reception resulting from the radiation of electrical or magnetic fields.
E. Entrance Facility (telecommunications): An entrance to a building for both public and private network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.
F. Equipment Room (telecommunications): A centralized space for telecommunications equipment that serves the occupants of the building. An equipment room is considered distinct from a telecommunications room because of the nature or complexity of the equipment.
G. Exothermic Weld: A method of permanently bonding two metals together by a controlled heat reaction resulting in a molecular bond.
H. Ground: A conducting connection, whether intentional or incidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

I. Grounding Electrode Conductor: The conductor used to connect the grounding electrode to the equipment grounding conductor, to the grounded conductor, or to both, of the circuit at the service equipment, or at the source of a separately derived system.
J. Grounding Equalizer (GE): A bonding conductor that interconnects TGBs on the same floor, (formerly TBBIBC).
K. Mesh Bonding Network (Mesh-BN): A bonding network to which all associated equipment (e.g., cabinets, frames, racks, trays, pathways) are connected using a bonding grid, which is connected to multiple points on the common bonding network.
L. Primary Protector: A surge protective device placed on telecommunications entrance conductors in accordance with ANSI/NFPA 70 and ANSI/ATIS 0600318 and listed under ANSI/UL 497.
M. Rack Bonding Conductor (RBC): A bonding conductor used to connect the rack/cabinet directly to the TMGB/TGB/Mesh
N. Room (telecommunications): An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling, that is the recognized location of the cross-connect between the backbone and the horizontal facilities.
0. Telecommunications Bonding Backbone (TBB): A conductor that interconnects the telecommunications main grounding busbar (TMGB) to the telecommunications grounding busbar (TGB).
P. Telecommunications Equipment Bonding Conductor (TEBC): A conductor that connects the telecommunications main grounding busbar (TMGB) or telecommunications grounding busbar (TGB) to equipment racks or cabinets.
Q. Telecommunications Grounding Busbar (TGB): The interface to the building telecommunications grounding system generally located in telecommunications room. A common point of connection for telecommunications system and equipment bonding to ground and located in the telecommunications room or equipment room.
R. Telecommunications Main Grounding Busbar (TMGB): A busbar placed in a convenient and accessible location and bonded, by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.
S. Unit Bonding Conductor (UBC): A bonding conductor used to connect u rack/cabinet mounted equipment unit to the grounding structure (i.e... conductor, busbar) utilized in that rack/cabinet.

PART 2 - PRODUCTS

2.1 CABLE

A. THHN: The telecommunications backbone shall be a copper conductor.
1. Shall be rated, plenum-riser, depending on the environment, or bare copper may be acceptable in approved applications.
2. Jacket color shall be green.
3. Cable size per table in Part 3.

2.2 BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB).
1. Predrilled copper with holes to accommodate lug mounting holes
2. 0.25” thick x 4” wide with varying length
3. Sized for current applications and future growth
4. Insulated from its support
5. The TMGB use a copper plated busbar
6. Maintain a 2” min clearance from wall
7. Size
a. 4” X 6” – Copper – Hubbell Part Number HBBB14416H
b. 4” X 6” – Copper – Hubbell Part Number HBBB14420J
B. Telecommunications Grounding Busbar (TGB)
1. Pre-drilled copper with holes to accommodate lug mounting holes
2. 0.25” thick x 2” wide with varying length

3. Sized for current applications and future growth
4. The TGB use a copper plated busbar
5. Maintain a 2” min clearance from wall
6. Size & material
   a. 4” X 6” – Copper – Hubbell Part Number HBBB14210A
   b. 4” X 6” – Copper – Hubbell Part Number HBBB14416H

C. Horizontal Cabinet or Equipment Rack Busbar - 19”
1. Mounts to standard 19” Rack or Frame
2. Capacity: 6 Double hole lugs
3. Size & material
   a. 0.75” x 19” x 0.25” – Copper - Hubbell Part Number HBBBHR19KT

D. Vertical Cabinet or Equipment Rack Busbar – 36 to 72”
1. Mounts to vertical rail or inside of cabinet in 19” or 23” Rack or Frame
2. Capacity: 9 Double hole lugs
3. Size & material
   a. 0.75” x 36” x 0.25” – Copper - Hubbell Part Number HBBBVR36KT

2.3 COMPRESSION LUGS

A. Shall be UL & CSA listed
B. Shall be able to accept 6 AWG to 3/0 AWG
C. Compression type
D. Two holes with various hole spacing to fit the busbar
E. Long barrel that will allow a minimum of two crimps with standard industry colors
F. An inspection window to verify that the conductor is fully seated in the lug
G. Have a traceable feature to ensure proper die size was used to make the crimp
H. Crimped according to manufacturer’s recommendation
I. Size (XX – specify AWG)
1. 0.250” holes X 0.625” spacing
   a. 0 degrees – Hubbell Part Number HGBLXXD
2. 0.250” holes x 0.750” spacing
   a. 0 degrees – Hubbell Part Number HGBLXXDA
3. 0.375” holes x 1.000” spacing
   a. 0 degrees – Hubbell Part Number HGBLXXDB.

2.4 TAPS

A. Connections to the Conductor shall be made with irreversible compression connectors.
B. Shall be UL & CSA listed
C. Shall be able to accept 6 AWG to 3/0 AWG
D. Have a traceable feature to ensure proper die size was used to make the crimp
E. Requires a minimum of (2) crimps for C Tap and H Tap, 1 crimp for I-Beam and busbar Tap
F. Crimp according to manufacturer’s recommendation.
G. C Taps:
1. Main Run 6-4 AWG - Tap 6 AWG
   a. Hubbell Part Number HYC4C6
2. Main Run 6-4 AWG – Tap 4 AWG
   a. Hubbell Part Number HYC4C4
3. Main Run 2 AWG – Tap 8-4 AWG
   a. Hubbell Part Number HYC2C4
4. Main Run 2 AWG – Tap 2 AWG
   a. Hubbell Part Number HYC2C2
5. Main Run 1/0-2/0 AWG – Tap 8-2 AWG
   a. Hubbell Part Number HYC26C2

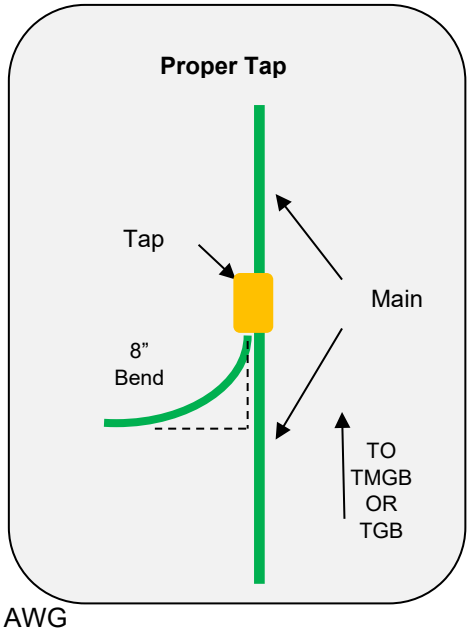


Illustration 1

6. Main Run 1/0-2/0 AWG – Tap 1/0-2/0 AWG
   a. Hubbell Part Number HYC26C26

H. I-Beam Tap
1. I-Beam steel with a Standard Flange
   a. Hubbell Part Number HYGIBS####
2. I-Beam steel with a Wide Flange
   a. Hubbell Part Number HYGIBW####

I. Busbar Tap
1. Busbar thickness 0.25”, Main Run 2 AWG - Tap 6 AWG
   a. Hubbell Part Number HYG14B2TC2C6C
2. Busbar thickness 0.25”, Main Run 2 AWG – Tap 2 AWG
   a. Hubbell Part Number HYG14B2TC2C2C
3. Busbar thickness 0.25”, Main Run 4/0 – 1/0 AWG
   a. Hubbell Part Number HYGBTC28

2.5 LADDER RACK BONDING CONDUCTORS

A. Ground cord assembly
1. Stranded THHN
2. Color: green
3. #6 AWG insulated bonding jumper
4. Length: 9” - 12”
5. Each end terminated with a two-hole compression lug or listing approved terminal
6. Hubbell Part Number HGRKTD12D, HGRKTKLU9KLU5

B. Braided Jumper
1. 0.94” Braid width
2. Hole diameter 0.375”
3. Hole Spacing 1.25”
4. Length: 12”
5. Hubbell Part Number HGBBD12

2.6 BASKET TRAY CONDUCTORS

A. Mounts to the basket tray metal runner
B. Accepts #6 AWG cable that spans the gaps between sections of basket tray
C. Hubbell Part Number HGBKS17, HGRKTWC45, HGRKTWB5

2.7 WRIST STRAP ESD PORT

A. Lug w/ 4mm banana plug to attach ESD wrist strap.
B. Two (2) hole lug
C. Placed inside cabinet or on equipment rack
D. Must be identifiable as an ESD connection point
E. Hubbell Part Number HGBESDKT10

2.8 RAISED FLOOR GROUNDING CLAMP

A. Ability to do both parallel and grid configurations
   1. HGBGXP1828RF - Grid or Parallel
B. Attached to the stringer of the raised floor
   1. HGBGXP1828RF - 0.75”-1.5” Round or Square
C. Wire Range
   1. HGBGXP1828RF 6 – 4/0 AWG

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS MAIN GROUND BUSBAR (TMGB)

A. The TMGB shall be:
   1. Pre-drilled copper with holes to accommodate lug mounting holes
   2. 0.25” t x 4” w with varying length
   3. Sized for current applications and future growth
   4. Insulated from its support
   5. Maintain a 2” min clearance from wall
   6. Installed to maintain clearances required by applicable codes
   7. In an accessible location
   8. As close to the panelboard as practicable min 36”
      a. Where a panelboard (electrical power panel) is located in the same room or space as the TMGB that panelboard’s alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure shall be bonded to the TMGB.
   9. Be listed by a nationally recognized testing laboratory
   10. 36” from active electronics or the panelboard
B. The TMGB should:
   1. Be located in the telecommunication entrance facility
      a. The ideal location of the TMGB is in the telecommunications entrance facility.
   2. Have a mounting height adjusted to accommodate overhead or underfloor cable routing.
   3. Minimize the length of bonding conductor for telecommunications
   4. Provide for the shortest and straightest routing of the primary
   5. Be located near backbone cabling and associated terminations
   6. Serve telecommunications equipment that is located within the same room or space.
C. The TMGB use a copper plated busbar.
D. Attachments to TMGB:
   1. Bonding Conductor – Electrical Distribution Panel
   2. Primary protector
   3. Building Steel
   4. Outside plant cables
   5. Backbone cables that incorporates a shield or metallic member
   6. All metallic pathways for telecommunications cabling located within the same room or space as the TMGB.
   7. Cable tray
   8. Ladder rack
   9. Conduit
   10. Telecommunications equipment located in the TEF (e.g., multiplexer or optical fiber termination equipment).
   11. TBB
   12. TEBC
   13. Primary protector grounding conductor
      a. A minimum of 1 ft. separation shall be maintained between this insulated conductor and any dc power cables, switchboard cable, or high frequency cables, even when placed in rigid metal conduit or EMT.

3.2 TELECOMMUNICATION GROUND BUSBAR (TGB)

A. The TGB shall:
   1. Be a predrilled copper busbar provided with holes for use with standard sized lugs,
   2. Have minimum dimensions of 6 mm (0.25 in) thick x 50 mm (2 in) wide and variable length to meet the application requirements and with consideration of future growth.
   3. Be insulated from its support attachment a minimum of 2”.
   4. Be listed by a nationally recognized testing laboratory (NRTL).
   5. Maintain 36” separation from active electronics.

B. It is acceptable that the busbar be electro-tin plated for reduced contact resistance. If not plated, the busbar shall be cleaned prior to fastening the conductors to the busbar, and an antioxidant should be applied to the contact area to control corrosion and reduce contact resistance.

C. The TGB is the grounding connection point for telecommunications systems and equipment in the area served by that telecommunications room or equipment room.

D. Where a panelboard is located in the same room or space as the TGB that panelboard’s ACEG bus (ac electrical ground when equipped) or the panelboard enclosure shall be bonded to the TGB. When a panelboard for telecommunications equipment is not in the same room or space as the TGB, that TGB should be bonded to the panelboard that feeds the distributor.

E. The TBBs and other TGBs within the same space shall be bonded to the TGB with a conductor the same size as the TBB.

F. Where a grounding equalizer (GE) is required, it shall be bonded to the TGB.

3.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunication systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:
   1. Be connected to the TMGB & TGB.
   2. Be a continuous copper conductor that should be sized no less than 6 AWG to a maximum of 3/0 AWG. The TBB shall be sized in accordance to the conductor table.

TABLE 1
CONDUCTOR LENGTH VS AWG

Linear length – ft.	Size (AWG)
Less than 13	6
14 – 20	4
21 – 26	4
27 – 33	2
34 – 41	1
42 – 52	1/0
53 – 66	2/0
Greater than 67	3/0

   3. Be consistent with the design of the telecommunications backbone cabling system.
   4. The TBB conductors shall be installed and protected from physical and mechanical damage.
   5. TBB conductors should be installed without splices.

a. Where splices are necessary, the number of splices should be a minimum and they shall be accessible and located in telecommunications spaces.
b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent.
c. Permit multiple TBBs as dictated by the building size.
d. The metallic cable shield not be used as a TBB.

3.4 GROUNDING EQUALIZER (GE)

A. The GE shall be a continuous copper conductor that should be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall be sized in accordance to the conductor table.
B. The GE connects the telecommunications grounding busbar(s) in the same-floor telecommunications rooms (TRs) on the first, top, and every third floor in a multistory building.
C. Cable shields do not satisfy the requirements for a GE.

3.5 TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR (TEBC)

A. Connects the TMGB/TGB to equipment racks/cabinets.
B. Shall be a continuous copper conductor that should be sized per the length of cable.
C. Shall be separated from ferrous materials by 2” or be bonded to the ferrous metal.
   1. May be routed within cable trays or suspended 2” under or off the side of the cable tray or ladder rack.
D. Shall be supported every 3ft.
E. 8” Bend radius – with no less than a 90-degree bend.
F. May come in contact with other cable groups at a 90-degree angle only.
G. Cable shields do not satisfy the requirements of a TEBC.
H. There may be more than one TEBC within each telecommunication room.

3.6 RACK BONDING CONDUCTOR

A. A bonding conductor used to connect the rack/cabinet directly to the TMGB/TGB/Mesh.
B. Metallic enclosures, including telecommunications cabinets and racks, shall be bonded to the mesh-BN, TGB, or TMGB using a minimum sized conductor of No. 6 AWG.
C. Cabinets, racks, and other enclosures in computer rooms shall not be bonded serially; each shall have their own dedicated bonding conductor to the mesh-BN, TGB, or TMGB.

3.7 ELECTRICAL DISTRIBUTION PANEL (EDP)

A. When located in the same room as the TMGB/TGB the EDP's equipment grounding bus or the panel board enclosure shall be bonded to the TMGB/TGB.
B. Using a bonding conductor for telecommunications (BCT) minimum 6 AWG to a maximum of 3/0 AWG depending on the length of cable required.
C. Use same AWB as TBB.
D. A qualified electrician shall make all connections within an AC electrical panel.
E. Outside of the scope of ANSI/TIA-607B.

3.8 CONDUCTIVE FIBER OPTIC CABLES

A. The metallic components of a conductive cable are capable of transmitting current.
B. Conductive fiber-optic cables should be bonded and grounded as specified in NEC Article 770.100

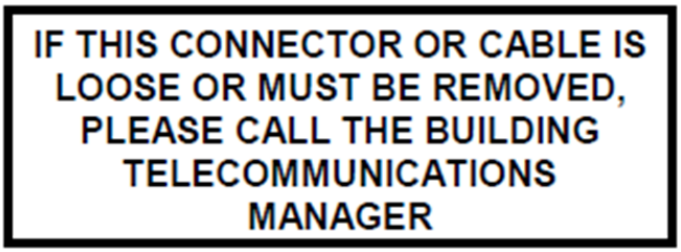
3.9 LADDER RACK AND/OR CABLE TRAY

A. To achieve the objective of potential equalization in the TR, all cable runway sections are bonded together and bonded back to the TMGB/TGB
B. Maintain a 8” Bend Radius on the TEBC
C. Keep a 2” separation from other cables, power and telecommunications
D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded

E. Drill two holes as required to accommodate the 2-hole compression lug
F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.
G. Attach straps to the runway using stainless steel hardware sized for the lug holes.
H. Tighten the hardware
I. Wipe off any excess antioxidant after installation of the lug.

3.10 LABELING

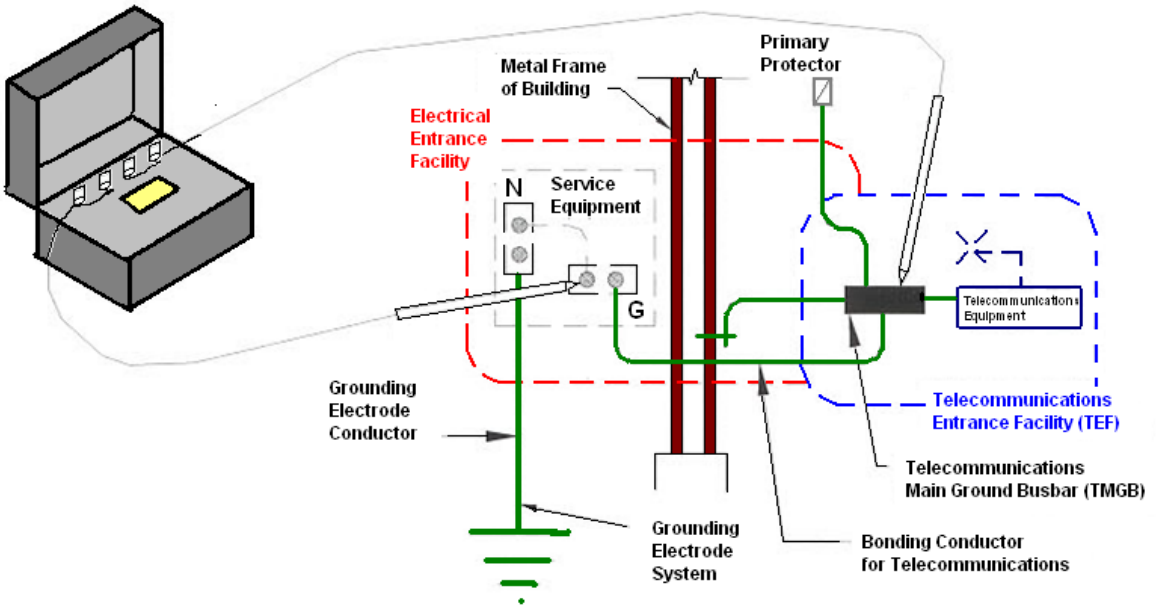
A. The format for the telecommunications main grounding busbar shall be FS-TMGB, while the format for the TGBs shall be FS-TGB.
   1. FS is the TS identifier for the space containing the busbar; Floor & space
   2. TMGB is the portion of an identifier designating a telecommunications main grounding busbar;
   3. TGB is the portion of the identifier designating a telecommunications grounding busbar.



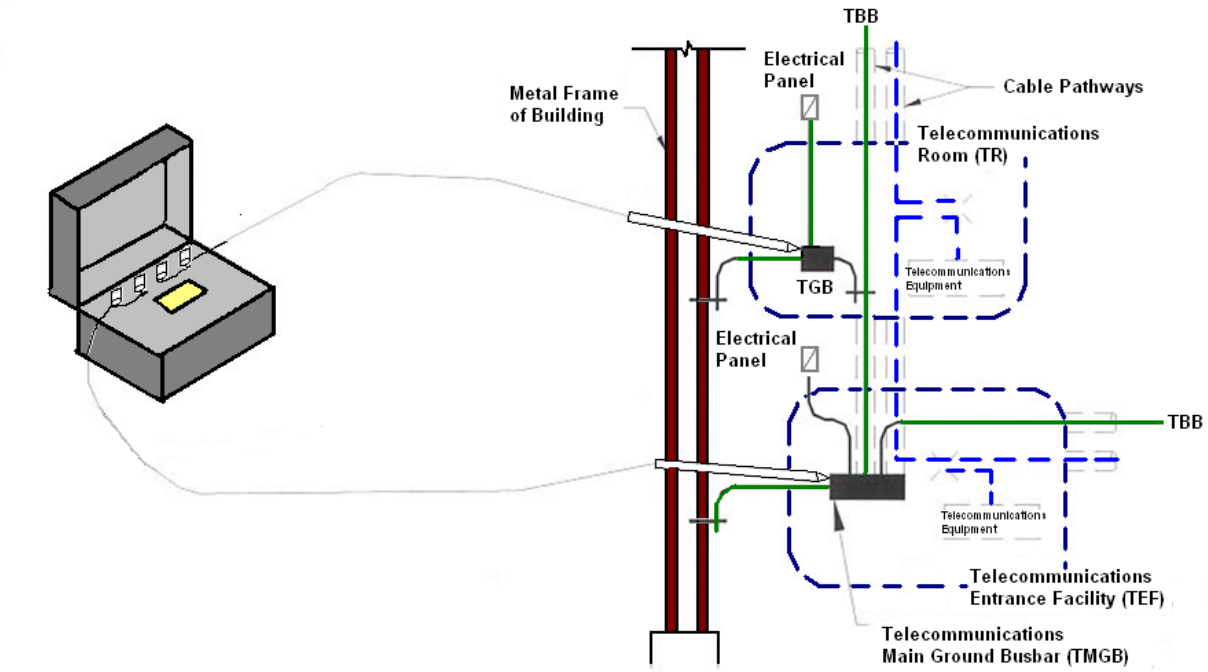
B. Each telecommunications space or room shall be assigned an identifier unique within the building. The TS shall be labeled with the TS identifier inside the room so as to be visible to someone working in that room. The TS identifier shall have a format of FS.
C. All busbars and cables will have the label in Illustration 2 attached, and it will be visible .and readable.

3.11 TESTING

A. Earth ground resistance tester:
   1. The earth ground resistance tester generates a specific test current: this current is less susceptible to the influences of stray currents on the grounding system. This makes the ground resistance tester a more accurate testing devise that a standard Volt-Ohm-multimeter.
B. Two-point ground continuity testing:
   1. Maximum value 100 milliohms
C. Follow manufacture instructions on setup and how to perform the test.



D. Care should be taken and safety precautions in place.



END OF SECTION

SECTION 27 1000
STRUCTURED CABLING SYSTEM (SCS)

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 DESCRIPTION

A. Summary of Work:
   1. Reference Attachment ‘A’ of this specification for supplemental scope as it relates to the project and the Owner standards.
   2. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
   3. An IDF will be required when the distance between outlet terminations and MDF/IDF exceeds 280’, including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
   4. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.
   5. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer’s shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project’s Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:
   1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.

2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
3. Only products listed in Attachment 'B' or approved in compliance with the project manual's approval requirements will be accepted.

B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State 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 Structure Cabling System installations.
2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
3. The installing contractor must have a full-time employed RCDD (Registered Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
4. All individuals installing the SCS 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.
5. 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. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.

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 provide the specified manufacturer's maximum end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level IIIe or better tester, per TSB-67, and that all test results conform to the most current ANSI/TIA-568.2-D.
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 ANSI/TIA/EIA-568.3-D. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

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. National Electrical Code, current version

B. Other References:
   1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
   2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
   3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
   4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
   5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
   6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
   7. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
   8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
   9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
   10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
   11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
   12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
   13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
   14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
   15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
   16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
   17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
   18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
   19. TIA/EIA 942 Data Center Standards
   20. Current BICSI Telecommunications Distribution Methods Manual
   21. NFPA 70 – National Electrical Code (NEC).
   22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).

C. Governing Codes and Conflicts: 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, regulations, and manufacturer installation requirements.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
UTP	Unshielded Twisted Pair

SCS	Structured Cabling System
RCDD	Registered Communications Distribution Designer

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. 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 UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
   e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS 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 approved by the Owner.
   f. Each Submittal must have a detailed parts list with quantities.
   g. Certifications: The contractor shall submit all certifications for approved products 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) BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
      2) Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.
      3) Certifications 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.
      4) Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and 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. Identifiable, separate routing shall be

shown for both the station cabling and the MDF-to-IDF tie cabling.

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 drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
   6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the SCS 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 approved by the Owner.

d. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. 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. Close out technology documents shall be separated from all other trade's documents. The close out finals 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 technical cabling 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, camera locations with

correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.

h. All drawings must reflect final graphic numbering, 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. Any 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. 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 4 hours.

m. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

PART 2 - PRODUCTS

2.1 GENERAL

A. Reference Attachment 'B' to this specification, which contains the minimum materials list for this specific project.

B. Installation:

1. 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.

C. Materials:

1. 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.

D. Testing:

1. All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.

E. Ratings:

1. 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

F. Initial Cable Inspection:

1. 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.

G. Cable Lubricants:
1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
2. Approved Products
a. Twisted-pair cable: Dyna-Blue
b. American Polywater

H. Fire Wall Sealant:
1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
2. Approved Products
a. 3M or
b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) HARDWARE

A. Equipment Cabinets/Cabinets:
1. Provide and install equipment cabinets and/or cabinets in locations indicated on the attached drawings for the following areas.
a. For all MDF/IDF locations:
Contractor shall provide and install a new floor mounted cabinet/rack system or a wall mounted cabinet where indicated on plans. Refer to floor plan and enlarged MDF/IDF room layouts for number of cabinets/racks to provide at each location. If an enlarged detail is not available, the contractor shall provide the required number of racks to accommodate 100% of all termination components and an equal amount of owner equipment; as well as (1) spare rack. If an MDF/IDF is located in shared space, the contractor shall provide a floor supported, wall mounted cabinet system with all required doors and side panels to secure the equipment and termination components.

B. Distribution Cabinet/Cabinet Grounding:
1. All Cabinets and/or Cabinets 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.

C. Fiber Optic Patch Panels:
1. The enclosures used shall provide termination panels for the specified type of 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” cabinet mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.
2. Provide closet connector housing panels, size for 110% of total fiber count to be terminated.
3. ALL fiber strands must be terminated in fiber housing.

D. Patch Panels:
1. All patch cables shall be modular type patch panels to allow individual jacks to be inserted. All patch panels shall be fully populated with Jacks. Provide dust caps for all unused jacks. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.
2. Provide cable support bars at the back of all patch panels to provide additional support at rear of panels. Provide one (1) support bar for each row of 24-ports. Support bars will not be required if the closet design consist of rear horizontal cable management above and below each patch panel.

E. Rack Electrical:
   1. A power strip shall be installed vertical at the back of each data relay rack.
   2. Project electrical contractor to provide and install one electrical receptacle for each UPS installed on the entire project. Coordinate receptacle type and location with the installed product requirements and the technology consultant prior to installation.

F. Cable Management Panels:
   1. Provide cable management panels as required for vertical cable management on ends and in between all racks on entire project.
   2. Provide Velcro straps for cable dressing in MDF/IDF rooms.

G. MDF/IDF Patch Cables:
   1. Cabling Contractor shall provide owner with one (1) 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. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
   2. All patch cables shall be factory terminated. NO EXCEPTIONS.

2.3 CABLE ROUTING/PATHWAY

A. Cable Tray:
   1. Metal cable tray shall be provided to affix to the top of all floor mount cabinets. Cable tray shall be used to brace cabinets to walls and to route cable from walls to cabinets in communication closets.
   2. Contractor to provide and install all applicable installation accessories.

B. Cable Support System:
   1. All low voltage cabling shall be installed and supported using an approved cable support system installed at 48” intervals unless installed in conduit. Do not exceed manufacturer’s recommendation for the quantity of cables supported in an individual support.
   2. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
   3. Cable supports shall not exceed a serviceable height of more than 5’, but no closer than 2’, above the finished ceiling.
   4. Cable supports can be attached to vertical walls or the building’s structure.
   5. If attached to the building’s structure, 3/8” threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.

C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

D. Conduit Bushings shall be installed prior to the installation of any cable. If cable is found to be installed without the bushing the cable will have to be removed and re-installed. No cut bushings will be accepted. If cable damage occurs during any portion of the installation, the cable will be removed and replaced at no cost to the project. This item will be strictly enforced and adhered too.

E. The projects electrical contractor shall provide and install all metallic conduit and backboxes indicated to be installed on the drawings. It is the SCS installer’s responsibility to coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. If box locations and conduit sizes are found to vary from the project documents after installation the SCS installer will bare all financial responsibility to ensure these items are installed correctly. The RCDD for the SCS will be responsible for ensuring conduit sizes are sufficient for cable count while maintaining a 40% fill ratio. If there is not electrical contractor on the project, the SCS Installer shall bear responsibility for the provision and installation of all required raceways.

2.4 STATION WIRING

A Wire:
1. The data and voice wire provided for all outlets shall be four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.

B. Testing:
1. The 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. All cable must be provided on new 1000-foot spools. No shorts will be allowed.

C. Rating:
1. 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.

D. All cable shall be routed to the center of the room in which it is serving and then route to the outlet location that it is intended for. Provide a 5’ service loop in the center of the room and 5’ service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.

E. Provide minimum of 10’ service loop at all headend locations properly supported above ceiling.

F. Provide indoor/outdoor, plenum rated category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

2.5 STATION HARDWARE

A. Information Outlet / Jack Modules:
1. Shall be high quality 8p/8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware
2. Shall be standard 8-position, RJ-45 Style, FCC compliant
3. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
4. Shall terminate 26-22 AWG solid or stranded conductors
5. Shall accept FCC compliant 6 position plugs.
6. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
8. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
9. Shall be UL Listed and CSA certified.
10. Each jack shall have category rating identified on the front face.

B. Faceplates:
1. Faceplates shall be a minimum of 4-port.
2. Wall mounted telephone faceplates shall be 1-port.
3. All faceplates shall be single gang.
4. All blank inserts color shall be coordinated prior to procurement.

C. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
1. Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
2. Patch cords shall be stranded copper, matching the category of the installed cable.
3. All patch cables shall be factory terminated. No exceptions

2.6 FIBER OPTIC PRODUCTS

A. Multimode:

1. 50/125um, OM4+, multimode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

B. Singlemode:
1. Single mode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations:
1. 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:
1. 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:
1. 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:
1. 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:
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.

H. Conduit and Back Boxes:
1. The Contractor shall ensure that the appropriate back boxes and conduits, for the project, are provided as required.
2. One (1) 1" conduit will be required each outlet that serves one to a maximum six (6) category 6 or a maximum of four (4) category 6A cables. Provide additional conduit for cable counts that exceed this number.
3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

3.2 EQUIPMENT CABINET CONFIGURATION

A. Equipment Cabinets:
1. 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:
   1. Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.

C. Cable Placement:
   1. 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:
   1. 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:
   1. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.

F. Hardware:
   1. Provide cabinet and jack panel hardware as required for all data station wiring.

3.3 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 UTP cable at either the wiring closet or the workstation termination locations.
   3. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5’ service loop shall be provide. An addition 5’ service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.

B. Exposed Cable:
   1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
   2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
   3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.

C. Placement:
   1. 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, or approved cable support with Velcro cable wrap at each location. 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. No support shall have more than 48 cables.
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 SCS.
4. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
   a. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.
   b. Provide data outlet for time clock appliance in main custodian office.
   c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

3.4 STATION HARDWARE

A. Flush Mount Jacks:
1. Flush mount jacks shall be mounted in a faceplate with back box.

B. Placement:
1. 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.
2. Outlets shall be installed within 3'-0" of power outlets

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)

3.5 CABLE TESTING REQUIREMENTS

A. Notification:
1. The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection:
1. 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:
1. 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.
2. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "* PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".

D. Errors:
1. 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. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. 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 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. Fiber Optic Cable Testing:
1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test t0.and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
5. Singlemode:
   a. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
6. Multimode:
   a. 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

3.6 INSPECTION

A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.

1. Written Test Report:
   a. Complete test results, including actual values associated with tests.
   b. Show all certifications for telecommunications wiring systems.
   c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
   d. Documentation of outlet, cable and cabinet labeling system.

B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND INSTRUCTIONS

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION OF WORK

A. This project consists of the provision and installation of a Structured Cabling System (SCS) as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity. ~~This project is a~~ renovation and addition of Creekwood Middle School and Riverwood Middle School~~new, _____ Square Foot, _____ for _____ for Humble ISD.. The project site will be located at _____ Rd., City of _____, State, ZIP Code. Reference Drawings for complete scope.~~

B. The work includes expanding~~provision and installation of~~ a complete Cabling System (SCS) in new areas in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.

C. The SCS Installer shall comply with all conditions of the contract and "Division 1 – General Requirements" as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.

D. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise.

1.2 STRUCTURED CABLING SYSTEM – ADDITIONAL INSTRUCTIONS

A. Base Proposal:

1. The SCS Installer shall provide and install an End-to-End Structured Cabling System as per these specifications and associated drawings. The Base bid SCS shall consist of:
   a. Category 6 cable and connectivity to each Video Surveillance Camera, Wireless Access Points, Voice/Data Outlet, Access Controlled Door, and any other locations requiring Local Area Network Connectivity.
   c. Each connectivity solution be a complete Channel Solution; consisting of jacks, patch panel, and patch cables.
   d. Each channel solution shall be color coded to the system in which it serves.
2. The products specified in Attachment 'B' are to require quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the SCS.
   a. Category 6 copper cable
      1) Commscope
   b. Category 6 copper termination components, and patch cables
      1) Commscope / Uniprise
   c. Fiber Optic Cabling and Components:
      1) Commscope / Uniprise
   d. Metals (racks, cable managers, and cable tray):
      1) Racks and Cable Tray
         i. Commscope
      2) Cable Managers
         i. Commscope

1.3 COPPER PATCH PANELS

A. The SCS Installer shall provide and install patch panels as per the instructions below.

1. 24-port patch panels shall only be used for copper tie cables and demarcation

extensions.

2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
   a. LAN and IP Telephones
   b. Wireless Access Points,
   c. IP Intercom
   d. Video Surveillance Cameras

1.4 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

A. The SCS Installer shall provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warrantied for the copper and fiber solutions specified.

1. MDF/IDF Copper Patch Cables:
   a. Patch cables shall be category 6
   b. Provide one patch cable for each port on the entire project
   c. Patch cables to be installed by network equipment installer/programmer
   d. Patch cable lengths
      1) 99% shall be 1’
      2) 1% shall be 6’
2. Work Area Outlet Copper Patch Cables:
   a. Patch cables shall be category 6
   b. Provide one patch cable for each port on the entire project
   c. Patch cables to be installed by the owner.
   d. Patch cable lengths
      1) 90% shall be 10’
      2) 10% shall be 15’
3. Wireless Access Point Copper Patch Cables:
   a. Patch cables shall be category 6
   b. Provide one patch cable for each port on the entire project
   c. Patch cables to be installed by wireless system installer.
   d. Patch cable lengths
      1) Interior access points: 100% shall be 10’
      2) Exterior Access Points: 100% shall be 15’
4. Video Surveillance Camera Copper Patch Cables:
   a. Patch cables shall be category 6
   b. Provide one patch cable for each port on the entire project
   c. Patch cables to be installed by the Video Surveillance System Installer.
   d. Patch cable lengths
      1) Interior Cameras: 100% shall be 10’
      2) Exterior Cameras: 100% shall be 15’
5. IP Intercom Copper Patch Cables:
   a. Patch cables shall be category 6
   b. Provide one patch cable for each IP Intercom device on the entire project, plus an additional twenty (20) for future use.
   c. Patch cables to be installed by the IP Intercom System Installer.
   d. Patch cable lengths
      1) 100% shall be 10’
6. MDF/IDF Fiber Optic Patch Cables:
   a. Patch cables shall be OS2 (Single-mode).
   b. Patch cable shall be duplex, LC to LC
   c. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
   d. Patch cables to be installed by network equipment installer/programmer
   e. Patch cable lengths

1) 100% shall be 3 meters

1.5 SYSTEM SPECIFIC COLOR REQUIREMENTS

A. The following information shall apply to the complete SCS Channel. All cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below:

Item	Description	Horizontal	Insert	Patch Cables
1	PA System	Blue	White	White
2	Data	Blue	Blue	Blue
3	Telephone	Blue	Blue	Blue
4	Wireless	Gray	Gray	Gray
5	Camera	Lime Green	Lime Green	Lime Green

1.6 DOCUMENTATION

A. Labels:

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 one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

1. The following nomenclature shall be used when labeling data/voice jacks:
   a. All cables being served by MDF closet shall begin with '1' all IDF served cables shall begin with numerical digit 2 thru 25) designating the specific IDF's identification.
   b. Next identification letter shall refer to patch panel that is serving outlet (A, B, C…)
   c. Next identification shall note what # data port on patch panel (01 thru 48).

Example:
Label of an outlet from 23rd port of the third patch panel from top of rack located at IDF-2 shall read: 2-C-23
Label of an outlet from the 5th port of the second patch panel from the top of rack located in the MDF shall read: 1-B-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. Access Points: Label ceiling grid with digital label according to location installed and a bright orange ¾" round dot sticker.

G. Contractor to provide a spreadsheet documentation of the intended labeling scheme to be reviewed by the project's consultant and Owner. Final approval to be provided by the Owner.

Attachment 'B'
Manufacturer and Material List

***The Communications Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Technology Consultant.**

MATERIAL LIST

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Hoffman	4-post Equipment Rack (45U) 12-24 Tapped Rails, Black	E4DR19FM45U	Provide as shown on Drawing, minimum of one (1) in the Building's MDF.
Hoffman	2-post Equipment Rack (45U) 12-24 Tapped Rails, Black	EDR19FM45U	Provide as shown on Drawing, minimum of one (1) in the Building's MDF and each IDF.
Hoffman	#6AWG, 2-Hole, Compression Lug	DGCL6*	* to be replaced with a numeric value depicting the dimension between holes. Contractor to coordinate with TGBB bonding point. Provide at TGBB and at each point bonding to the rack system. Each compression lug shall be bonded utilizing both holes.
Hoffman	Copper Ground Buss Bar, 1/4 in x 4 in x 12 in	DGTB412	Provide one (1) in each MDF and IDF on the entire project
Commscope / Uniprise	Ready™ 1U Fiber Optic Internal Sliding Shelf, black	760231449 | SD-1U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the IDFs, if not shown on drawings
Commscope / Uniprise	Ready™ 2U Fiber Optic Internal Sliding Shelf, black	760231456 | SD-2U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings
Commscope / Uniprise	Adapter Pack, Black, 1000-Type, with 1 TeraSPEED® 12 fiber, SM LC ganged adapter, blue, shuttered	760148254 | PNL-BK-012-SFA-LC12-BL	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
Commscope / Uniprise	Distribution Module Panel, Cat 5E, 1U, 24 port	760180000 | CPP-5E-DM-1U-24	Provide in quantities as required to terminate 100% of all copper backbone cable. Reference project drawings.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope / Uniprise	Distribution Modular Panel,2U, 48 port	760207282 | CPP-UDDM-M-2U-48	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Commscope / Uniprise	Vertical Cable Management Kit, 8in X 84in (203mm X 2134mm) Double Sided, With Doors, Black	760244780 | VCM-DS-84-8B	Provide and install between each rack and at both ends of all rack systems
Commscope	Cable Runway 10 ft (3048mm) L x 12 in (305mm) W, Black	760085647 | CR-SLR-10L12W	Provide as shown on drawings. Tray shall route to and between all racks, in each MDF/IDF, on the entire project. In addition to cable tray shown, provide vertically installed sections at each location where cables enter the room, routing down and up vertical walls and at the Service Provider's entrance location
Commscope	Cable Runway, 90° radius flat corner bend, 12 inch (305 mm) W, black	760085530 | CR90FCB-12W	Provide as shown on drawings
Commscope	Cable Runway, 90° radius vertical bend, 12-inch, black, outside bend	760086082 | CR90OCB-12W	
Commscope	Cable Runway, 90° radius inside corner bend, 12 inch (305 mm) W, black	760085688 | CR90ICB-12W	
Commscope	Runway to Rack Mounting Kit, 19-inch (482.6 mm) W, 5.375-inch (136.5 mm) D, black	760084053 | CRR2RRMK	Provide one (1) per rack and Cabinet installed.
Hoffman	Runway Stand-Off (Elevation) Kit, 4" - 6"	LEK6	Provide one (1) per rack and Cabinet installed.
Commscope	Cable Runway, wall angle support kit, 6 inch (152 mm), 12 inch (305 mm) wall rail support kit, black	L760084145 | CR6-12WRSKWASK122BLK	Provide one (1) at each location where cable tray terminates at a vertical wall
Commscope	Triangular Runway Wall Support Bracket Kit, 12 inch (305 mm) W, black	760084095 | CRTWSBK-12W	Provide one (1), every 5', for all tray that routes horizontally along a vertical wall.
Commscope	Cable Runway, protective	760084012 | CRPECK	Provide one (1) pair at

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
	end cap kit (2 caps), black		each exposed end of all cable tray installed
Commscope	Cable Runway, junction splice kit, black	760084046 | CRTJSK	Provide one (1) set at each location where cable trays intersect.
Commscope	Cable Runway, butt splice kit, black	760083899 | CRBSK	Provide one (1) set at each location where cable tray ends butt together
Commscope	Cable Tray Grounding Kit	760109124 | CRGND	Provide one (1) at each junction and inline butt connection for all cable tray on the entire project.
Commscope	Cable Runway, rung drop out ,12 inch (305 mm) W, black	760083956 | CRDK-12W	Provide one (1) at each location where cables drop, from the cable tray into the termination rack.
Commscope	Cable Runway Vertical Wall Bracket Kit (2 Brackets), Black	760084137 | CRVWBK	provide as required to secure vertically mounted runway to the wall.
Commscope	Cable Runway, cable retaining post, 6 inch (152 mm) H (1 Each), black	760083972 | CRRP-6H	Provide one pair per every three feet of cable runway.
Commscope	CS34P ETL Verified Category 6 U/UTP Cable, plenum, blue jacket, 4 pair count, 1000 ft (305 m) length, CommPak	UN8740yyy14/10 | CS34P yyy C6 4/23 U/UTP CPK 1KFT	'yyy' to be replaced with alphabetic and/or numeric characters depicting the color of the cable. Colors shall comply with designated color of the system each cable is provided for.
Commscope / Uniprise	Modular Jack, RJ45, category 6, T568A/T568B, unshielded, without dust cover, blue	7602377yy | UNJ600-yy	'yy' to be replaced with numeric character depicting the color of the Information Outlet (IO). Colors shall comply with designated color of the system each IO is provided for.
Commscope / Uniprise	Category 6 U/UTP Patch Cord, RJ45 to RJ45, 4-pair, Non-Plenum	UC1BBB2-0xFyyy	x' to be replaced with alpha or numeric character depicting the color of the patch cable. 'yyy' to be replaced with a numeric value depicting the patch cable length, in feet. Colors shall comply with designated color of the system each cable is

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
			provided for. Length to comply as stated in these specifications.
Commscope / Uniprise	1-Gang SS Faceplate with label window	760072yyy | MyySP-L	'yyy' or 'yy' to be replaced with numeric characters depicting the port quantity. Minimum port count shall be 4-port, with the exception of special outlet requirements (i.e.. Wall phones). All faceplates shall have label windows.
Commscope	TeraSPEED® Plenum Distribution Cable, interlocking aluminum armored with plenum jacket, 12 fiber single-unit	760127803 | P-012-DZ-8W-FSUYL	Provide for all MDF-to-IDF fiber optic backbone within a building
Commscope	TeraSPEED® Indoor/Outdoor Plenum Distribution Cable, interlocking aluminum armored with plenum jacket, 12 fiber single-unit	760134924 | P-012-OZ-8W-FSUBK	Provide for all exterior fiber optic backbone routing between buildings
Commscope / Uniprise	TeraSPEED® Fiber Qwik II-LC Connector™, field installable, aqua	760117895 | SFC-LCF-09-8X	
Commscope / Uniprise	TeraSPEED® LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser	FEWLCLC42JXF3	
Commscope / Uniprise	25-Pair PowerSUM U/UTP 2061F Series Plenum Cables	2010B WH 25/24 R######	Provide one (1) from the MDF to each IDF on the entire project. #### to be replaced with numeric characters that depict the cable length
Dynacom	Unwired, 66-Style Termination Block with clear, hinged cover	66M1-50	Provide one (1) for each 25-pair demarcation extension cable, located and installed next to the building demarcation point.
Dynacom	66 wiring block, metal backboard, blue in color	183C*M	* to be replaced with a numeric value depicting the board size. Provide at each demarcation point for the mounting of the 66 wiring blocks. Board size shall consist two (2) mounting brackets per 25-pair cable installed.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Ditek	10GbE, Single Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-MRJPOES	Provide one for each copper network cable associated with an exterior device, up to two (2) cables. Bond to TGBB per manufacturer's instructions
Ditek	Rack Mount,10GbE, 12-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM12NETS	Provide one for every four (4) to ten (12) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
Ditek	Rack Mount,10GbE, 24-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM24NETS	Provide one for every Thirteen (13) to Twenty-Four (24) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
~~EXTENDED DISTANCE POWERED FIBER FOR WIRELESS AP AND VIDEO SURVEILLANCE CAMERAS~~			

END OF SECTION

SECTION 27 4116.20
AUDIO AND VIDEO DISTRIBUTION SYSTEMS FOR SPECIAL VENUES

PART 1 – GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
   1. General Conditions
   2. Supplementary Conditions
   3. Division 1
   4. Division 26 in its entirety.
   5. Division 27 in its entirety.
   6. Division 28 in its entirety.

1.2 DESCRIPTION

A. Summary of Work:
   1. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Video and/or Sound Distribution System at the following Venues at Creekwood Middle School and Riverwood Middle School:
      a. Band Hall
      b. New Gym
      c. New Dance
   2. All applicable equipment shall bear the UL label.
   3. Governing Codes and Conflicts: 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, regulations, and manufacturer installation requirements.
   4. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.
   5. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
   6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available product warranty.
   2. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% 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.

3. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.
4. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.
5. The bidder shall have an authorized service center, within 75-miles of the project's location, for the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.
6. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
7. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.

B. 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.
2. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.
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.

C. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

D. Warranty:
1. The selected system installer shall be factory authorized service center and shall provide an end-to-end performance warranty of not less than one (1) year. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that video projection system projectors have been tested to the district's approval. This end-to-end warranty shall cover the labor associated with removing/reinstalling any associated hardware or equipment as well as the replacement of all defective equipment or hardware.
2. The bidder shall also submit with the materials mentioned in section 1.5 submittals of this specification a written explanation outlining the terms and conditions of product warranty of all parts and service of the integrated a/v solutions.

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. National Electrical Code, current version

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: 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:
1. AV-*# Audiovisual input station / Presentation Station (Reference drawing legend) CMP Ceiling Mounted Projector LCD or LED Flat panel screen/monitor

1.6 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
2. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, 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.
3. 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.
4. Testing: Proposed Contractor test result forms, and a list of instrumentation to be used for systems testing.
5. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
6. The resume and contact information of the full-time service personnel responsible for the installed projection system.
7. Specification Compliance: A letter shall be provided stating, by section and subsection, that the 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.
8. 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.
   a. AMX authorized dealer certification
   b. Installer training certification

1) Provide specification with line by line acknowledgement of compliance.

B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   1. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
   2. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
      a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
      b. Location of sleeved wall pass-thru
      c. Size of sleeve at each location installed
      d. Quantity of cable passing through each sleeve
      e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
      f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
   3. Drawing Compliance: A letter shall be provided stating that the 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 PROJECT'S TECHNOLOGY CONSULTANT.

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for 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. 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.
   3. 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 on disc or USB drive with the project name and description (2 copies).
   4. Provide schematic line diagram of system components as deployed in each installation.

PART 2 – PRODUCTS

2.1 GENERAL

All products listed in this section shall be provided and installed by the contractor unless otherwise noted below. The following list is not intended to be a complete list of required equipment or cables as the project is to be Turnkey and may require equipment beyond the depth of this list. It is the contractor's responsibility to ensure that they are providing a complete and functional system with their proposal

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 BAND HALL – AUDIO DISTRIBUTION

A. Contractor to provide and install a complete video and audio distribution system in compliance with the equipment specified in the table below and associated drawings. Installation shall turnkey, including programming, testing, and training.

MFR	PRODUCT NUMBER	DESCRIPTION
STRONG	Strong-SR-FS-SYSTEM-DC21U	Foundation Rack System with DC Fans
FURMAN	Furman M-8x2	15A standard power conditioner, 9 outlets, 1 ru, 6ft cord
ALESIS	Multimix 10 Wireless	10 channel Mixer with Bluetooth
Tascam	Cd-400U	CD/SD/USB Player with Bluetooth receiver and AM/FM Tuner
QSC	QSC-GXD8	Light weight class-d professional power amplifier with DSP, 2 channels, 800 watts/ch at 8 ohm
Gator	Gator-GRW-DRW2	Rack drawer, 14.2" deep, lockable, 2U
Gator	Gator-GRW-DRW4	Rack drawer, 14.2" deep, lockable, 4U
QSC	QSC-E112	12" 2- way, externally powered, live sound reinforcement loudspeaker – only available in block

MFR	PRODUCT NUMBER	DESCRIPTION
QSC	QSC-E12-Yoke	Powder coated steel yoke for mounting the E12 or E112 horizontally or vertically - black
Roland	R-RCC-3-TRXM	Black Series 3ft interconnect cable ¼" TRS-XLR(male)
Roland	R-RCC-3-TRXF	Black Series 3ft interconnect cable ¼" TRS-XLR(female)
Roland	R-RCC-10-3535	Black series 10ft interconnect cable, 3.5mm TRS –3.5mm TRS, Balanced
Shure	Shure KSM1237/SL Stereo	Two KSM137, two foam windscreens, A27M Stereo Microphone Adapter, carrying case.
Atlas	Atlas-AD-12BE	Surface mount male mic flange 5/8"-#27 thread ebony finish
Atlas	Atlas-AD-19B	Extension Tube 45 degree angle tube; 5/8" #27 thread chrome
Hosa	MCL-150	Microphone cable, Hosa XLR3F to XLR3M, 50ft.
Denon	Denon-DN-900R	Network SD/USB Audio Recorder with Dante 2x2 interface
Mackie	Thump212	12" 1400W powered loudspeaker. Speaker at back of band hall. Transmit from the front mixer to this speaker wirelessly. Requires power.
OnStage	SS7322B	Adjustable Wal Mount Speaker Bracket, for mounting on flat surfaces. Angle Adj:30-90 degrees. Fits 1-3/8" cabinet inserts, black finish
Alto	Stealth Wireless MK2	Stereo wireless kit for active speakers

2.3 NEW GYM AND DANCE – AUDIO DISTRIBUTION

A. Contractor to provide and install a complete audio and video distribution system in compliance with the equipment specified in the table below and associated drawings. Installation shall turnkey, including programming, testing, and training. Gym and Dance shall have the same head end location. Each space shall be independent and have its own speakers microphones and audio inputs.

MFR	PRODUCT NUMBER	DESCRIPTION
AtlasIED	324-15	Wall mount rack
AtlasIED	ECS-3	Power sequencer/conditioner
AtlasIED	AP-GNL18	Goosneck Lamp
AtlasIED	SD 3-14	Storage drawer
BSS	Blu-100	DSP
BSS	Blu-10	Wall controller for Blu-100
Shure	QLXD 124/85	Wireless mic kit x4
Shure	UA844+SWB	Wires antenna combiner
Shure	UA8100	100' remote antenna cables x2
Shure	UA8	½ wave antenna
Shure	UA834WB	Active antenna amplifier
Denon	DN-350UI	Internet radio media plater
Denon	DN-300C MKII	CD/Media Player
Proco	iRack	Rack mounted ipod input plate

MFR	PRODUCT NUMBER	DESCRIPTION
	WP1004	Single gang microphone jack
JBL	328/CT	2 way co-axial speakers
ElectroVoice	EKX15P	Powered speaker(gym only)
ElectroVoice	TSP 1	Tripod stands (2) with carry bag (gym only)
	P222CS	22ga/2 conductor shielded wite
	P142C	12ga/2 conductor wire

2.5 AUDIO AND VIDEO COMPONENTS AND EQUIPMENT - ALL VENUES

A. Custom Plates
   1. Liberty Panel Crafters, Proco, or RCI are approved manufacturers.
   2. Provide custom plates as indicated on the drawings.

B. Equipment Rack: Provide and install equipment rack at locations designated on the contract drawings. Equipment rack shall consist of the following:
   1. Enclosure:
      a. Atlas Sound 300 Series wall mount rack with 6 spare keys. (1 per venue). Provide size to accommodate all equipment, plus an additional 25% for future growth.
   2. Additional Accessories:
      a. Middle Atlantic D3 (3) space rack drawer (1 per venue)
      b. Juice Goose JG 8LED Power Distribution Center with LED Lighting (1 per venue)
      c. Juice Goose CQ 1520 Sequenced Power Control System (1 per venue)
      d. Provide any additional hardware or lacing strips to make a complete installation
      e. Provide blank panels necessary to enclose rack completely.

C. Miscellaneous Equipment
   1. Provide the following equipment for each venue, unless noted otherwise. (excluding the Advanced Culinary Lab, Weight Room, and Wrestling Room)
      a. (2) Shure SM58S-LC Microphones, per venue
      b. (1) 25’ Microphone cable, per venue
      c. (1) 50’ Microphone cable, per venue
      d. (2) Atlas MS20E Mic Stand, per venue
      e. (1) Atlas TL34-15E Boom Stand, per venue

D. Assistive Listening
   1. Provide a remote antenna. Adjust DSP for “hard knee” compression on assisted listening output. Test and use equalization for maximum sound quality.
      a. Listen LT-800-072-01 – Assisted Listening RF Transmitter
      b. Listen LA-326 Universal Rack Mounting Kit
      c. Listen LR-500-072-P1 Advanced Intelligent DSP RF Receiver
      d. Listen LA-430 Intelligent Ear Phone/Neck Loop Lanyard
      e. Listen LA-380-01 Intelligent 12-Unit Charging/Carrying Case
      f. Provide quantities needed to fulfill the quantities stipulated in the Receivers for Assistive Listening Systems Table.
      *if part numbers are obsolete update with manufacture recommended replacement

RECEIVERS FOR ASSISTIVE LISTENING SYSTEMS TABLE

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats	2

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
201 to 500	2, plus 1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1000	20, plus 1 per 33 seats over 500 seats	1 per 4 receivers
1001 to 2000	35, plus 1 per 50 seats over 1000 seats	1 per 4 receivers
2001 and over	55, plus 1 per 100 seats over 2000 seats	1 per 4 receivers

E. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
   1. AV Control Panel Configuration
   2. Audio routing from any source location through the DSP
   3. Projector and screen control via the Audio / Video Control panel
   4. Device resolution and over/under-scanning settings
   5. Incorporation of any Owner furnished source equipment (maximum of 2)

2.6 DISPLAY AND PROJECTOR MOUNTING HARDWARE

A. Wall Mounted Monitors: Provide the following at each wall mounted flat screen display location on the entire project
   1. Universal Articulating Wall Mount: Peerless Product No. PLAV70-UNLP
   2. Provide Triple Stud Wall Plate for each, stud-wall, wall mounted solution: Peerless Product No. WSP(716 or 724). Coordinate exact model with stud-wall construction. Coordinate desired finish color with architect and owner at each location.

B. Provide the following mounting hardware at each Ceiling Mounted Projector location (if not associated with a projector lift).
   1. One (1) 2'x2' Above Suspended Ceiling Storage Box with Column Drop, Chief Product No. CMS492C
   2. One (1) Adjustable Extension Colum, Chief Product No. CMS####*
      a. Height adjustment in 1" increments
      b. 1.5" NPT, threaded on both ends
      c. '####' to be replaced with a numeric value depicting the minimum and maximum adjustment capabilities. The center setting shall be equivalent to the height at the top of the projection surface but shall not exceed a maximum extension capability of 5'.
      d. '*' to be replaced with a 'W' if required in white.
   3. One (1) Universal projector mount with keyed locking, Chief Product No. RPM#U*
      a. '#' shall be replaced with an alphabetical character that shall depict the product version
      b. '*' to be replaced with an alphabetical character depicting the mount color.
   4. All product finish colors shall be coordinated with the architect. Color should match the color of the mounted device and the finish of the surface it is mounted to.

C. Projector Lift
   1. 350 lb. Maximum Lift Capacity
   2. 15' to 17' extension capacity
   3. Provide the following optional accessories:
      a. Environmental Airspace Housing
      b. Ceiling Closure Panel, white in color
      c. Universal-Style Projector Mounting Bracket
   4. Approved Manufacture:
      a. Draper

5. Coordinate installation location with screen and required throw distance.
6. Provide one (1) projector lift at each of the following locations:
   a. Gymnasium

2.7 AUDIO VISUAL PATCH CABLES

A. Provide and install the following Patch Cables
   1. Provide the following at each AV Input Outlet:
      a. One (1) 10’ HDMI Patch Cable, C2G Product No. 56784
      b. One (1) 10’ 3.5MM Stereo Audio Cable, C2G Product No. 22602
      c. One (1) 10’ USB(A)-to-USB(B) Cable, C2G Product No. 54175

   2. Provide the following at each AV Output Outlet:
      a. One (1) 6’ HDMI Patch Cable, C2G Product No. 56783
      b. One (1) 6’ 3.5MM Stereo Audio Cable, C2G Product No. 22601
      c. One (1) 6’ USB(A)-to-USB(B) Cable, C2G Product No. 54174

2.8 CABLE ROUTING/PATHWAY

A. Cable Support System: All audio-video cabling shall be installed and supported using an approved J-Hook 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.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor is required to properly mount integrated A/V solutions and connect all ceiling video / audio cables to projector component inputs.

B. Contractor is required to thoroughly test and verify operation of all A/V 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: 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).

F. 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. 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: 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 all category 6 cable. There shall never be more than one and one-quarter inch of unsheathed enhanced Category6 UTP cable at either the wiring USB Transmitter or Receiver.

B. Exposed Cable: 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 an approved J-Hook 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 mounted components: all component shall be inserted to a flush mounted faceplate unless designated otherwise.

B. Placement: Where possible, the AV input outlets 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. The CMP outlet shall route directly to the rear of the projector and does not require any type of faceplates.

3.5 PROGRAMMING

A. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:

1. AV Control Panel Configuration
2. Audio routing from any source location through the DSP
3. Projector and screen control via the Audio / Video Control panel
4. Device resolution and over/under-scanning settings
5. Incorporation of any Owner furnished source equipment (maximum of 3)

3.6 FINAL 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. Testing procedures shall consist of, but not me limited to the following:
   1. Input locations to be tested utilizing multiple types of source equipment. Equipment to include:
      a. Personal Computer (laptop)
      b. Apple iMac
      c. Apple Mac Mini
      d. Google Chromebook
      e. Additional devices may be required at the time of testing
      f. contractor to provide devices on a single cart, to roll between inputs during testing.
   2. Routing of video, from any source, to each projector and display simultaneously and independently.
   3. Routing of audio, from any source, to each audio channel simultaneously and independently.
   4. Control of the entire system from each installed A/V Control Panel
   5. Additional test requirements may be required at the Owner and/or Consultant's request.

3.7 OWNER TRAINING AND DEMO

A. A/V integrator shall provide demonstration of all integrated a/v solutions to owner's staff that have any stake with the operation and maintenance of the a/v solutions. Integrator shall produce sign in sheets for record of who was trained and when. Copies of sign in sheets shall be submitted with close out paperwork. Coordinate training dates with owner at project completion.

B. Integrator shall provide factory training for owner's operations and maintenance personnel for each major component of the systems listed in the A/V solutions outlined in part 2 of these specifications. Training shall be a minimum of 4 hrs. per person. Re-training of staff shall be available, at no cost to the owner, to a maximum of 3 on-site training sessions up to 1 year from the date of project competition.

C. All training is to be recorded via video recording and a copy of the recorded video shall be provided to the owner upon completion. All video recording equipment, for the recording of training, shall be provided by the integrator.

END OF SECTION

SECTION 27 5000
BUILDING INTERCOMMUNICATIONS SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
   1. General Conditions
   2. Supplementary Conditions
   3. Division 1
   4. Division 26 in its entirety.
   5. Division 27 in its entirety.
   6. Division 28 in its entirety.

1.2 GENERAL REQUIREMENTS

A. The contractor shall furnish and install all required materials to expand the existing, intercom system as shown on the project drawings. It shall be the responsibility of the installing contractor to design the expanded/renovated areas of the system in accordance with the latest codes and standards.

B. The contractor shall field verify the manufacturer, model, expansion capabilities, and location of the existing system.

C. The system expansion shall be provided and installed by the manufacturer's authorized contractor. Certification shall be submitted verifying that the contractor is the manufacturer's authorized contractor. Included shall be certificates of attendance in manufacturer's installation / maintenance training by the contractors directly employed personnel. The communications contracting company shall have been in business for a minimum of 5 years, continuously furnishing the specified manufacturers' product lines and systems.

D. The system expansion assemblies shall be completely factory built and tested by manufacturers of established reputation, who have and can refer to similar systems which are currently installed and functioning properly. The factory pre-assembled cabinets, consoles, and power supplies shall be UL approved and listed.

E. The system's expansion shall be guaranteed for a period of one year from the date of acceptance or first beneficial use, whichever is first, against defects in materials, workmanship, design and improper adjustment. Any defects in the system's expansion shall be corrected at no expense to the Owner, provided the system does not show signs of abuse. During the guarantee period any work found not to be in conformance with the plans, specifications and addenda shall be brought into conformity with same at no additional cost to the owner.

F. The equipment described herein and furnished per these specifications shall be supplied by one communications contractor. The contractor shall hold the necessary License for this type of work. Equipment shall be manufactured by the same manufacturer of the existing system and all work shall be performed by a certified dealer of the existing manufacturer. Contractor is required to submit current certification from manufacturer with submittals.

G. Approval request for installation of equipment not as specified herein must be received by the architect not less than ten days prior to bid opening. Proposals must be accompanied by complete technical data as well as a list of at least 10 references for successful Telephone / Intercom / Clock system installations. All potential bidders submitting proposals for substitute system approval must provide a working demonstration system, for the owner's inspection prior to final acceptance, to ensure that the submitted components are equal to the specified in all functional aspects. Demonstrations shall be provided at the owner's chosen location at no cost or inconvenience to the owner's personnel.

H. Alternative proposals which are approved, for bidding purposes only, will be published by addenda. Proposals not complying with the prior approval requirements and conditions set

forth will not be considered.

I. The contractor shall make available, and maintain a radio dispatched mobile service department capable of furnishing equipment inspection and timely service at the Owner's location.

J. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

K. The contractor shall instruct personnel designated by the owner in the proper use, basic care, and maintenance of the equipment. Such training shall be provided as an integral component of the system.

L. The contractor shall submit certificates of factory authorization and completion of the manufacturer's telephone installation and maintenance training.

M. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 CONTRACTOR QUALIFICATIONS

A. The installing contractor shall be the authorized representative of the intercom system to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the intercom manufacturer's product for at least two years.

B. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

C. The installing contractor must have a permanent office within a 120-mile radius of the project site and be an approved dealer/integrator, of the proposed system, in the nearest major metropolitan area.

D. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing systems in the surrounding area for at least ten (10) years.

E. All individuals installing the intercom 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.

F. The entity providing pricing to furnish and install the system specified within this specification section and the physical installing entity of this system shall be one in the same. Absolutely no subcontracting on any portion of this system, by the system's proposing entity, will be allowed.

1.4 SUBMITTALS

A. Product Data:

1. Within fourteen (14) days of Notice to Proceed, the 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, termination components, cable supports, cable labels, field 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. 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 system test result forms and a list of instrumentation to be used for systems testing.

e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system 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) Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 120-mile radius of the project's location.

2) Installer Certification: This certification 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.

3) Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system

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 system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.

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 all control equipment and remote power sources
2) Locations of all field devices and outlets
3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
4) Location of sleeved wall pass-thru
5) Size of sleeve at each location installed
6) Quantity of cable passing through each sleeve
7) Location of drops in each room (quantity or labeling of drops are

not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)

8) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the system 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 approved by the project's technology consultant.

C. Close-out Procedures:

1. Four (4) copies of the following documents shall be delivered to the Architect/Engineer at the time of system acceptance. One (1) final copy of the same documents shall be delivered directly to the project's Technology Consultant upon final closeout of the project. The closeout 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 and 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 technical cabling 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, device locations with correct labeling, control equipment locations, remote power supply locations, cross-connect locations, lightning protection locations, and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad 2002 or later. Provide the Owner with electronic versions of the as-builts on CD media and (1) hard copy per binder.

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. Any 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. 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 4 hours.

m. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

1.5 FUNCTION - INTERCOM

A. General: The contractor shall verify and document the functions of the existing system. All function of the existing system shall remain and be expanded to the newly added devices installed per the project drawings.

B. Use materials and equipment that comply with referenced standards and manufacturer's standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

1.6 FUNCTION - MASTER CLOCK: THE MASTER TIME CONTROLLER IS EXISTING TO REMAIN.

PART 2 - PRODUCTS

2.1 **EQUIPMENT**

All head end equipment is existing to remain. The following system information if provided in the event that the information is not obtainable. Provide all necessary expansion equipment as required.

A. Existing headend equipment
   1. Creekwood: Atlas Sounds 400
   2. Riverwood: Bogen GS 250

B. External Paging Amplifier
   1. External paging amplifiers shall be provided as required to meet the load requirements to the system when activated in the all-page mode.
   2. Program/paging amplifiers shall have the following:
      a. Power output of 250 watts RMS.
      b. Maximum .5% harmonic distortion from 45-20KHz.
      c. Frequency response of 20Hz to 20 KHz (+0, -1 dB).
      d. -90- dB signal to noise ratio at 20Hz to 20 KHz.
      e. 1-volt RMS input sensitivity at 1 KHz.

C. Speakers, Ceiling, Pendant, and Beam Mounted
   1. Lay-In Ceiling Speakers:
      a. General Purpose Speaker: 8" speaker with 5 oz. magnet complete with line matching transformer. Program rating shall be 5 watts continuous. The speaker shall be a Quam System 12, 2x2 lay-in at grid ceilings and Quam Solution 1 at hard ceilings. 25/70V transformers shall have primary taps of 0.25, 0.5, 1, 2 and 5 watts. Tap speaker at 0.25 watt.

White finish unless indicated otherwise.

b. Classroom, office, conference, telephone, teacher lounge, workroom speakers: 8-ohm speaker with 5 oz. magnet, complete with line matching transformer. Program rating shall be 4 watts continuous. The speaker shall be a Quam System 12/VC 2x2 lay-in at grid ceilings and Quam Solution 2 at hard ceilings, with integral volume control. 25/70V transformers shall have primary taps of 0.25, 0.5, 1, 2, 5 watts; tap speaker at 0.5 watt.

2. Solid Ceiling Speakers:
   a. 8" O.D. loudspeaker with 10 oz. magnet, 4W/70V Transformer with 5 tap settings (0.25W, 0.50W, 1.0W, 2.0W, 4.0W). Quam Product No. C10X/B70/WS/VC
   b. Provide Backbox Enclosure, Quam Product No. ERD8U
3. Pedant Mount Speakers:
   a. 8" 2-way pendant mount speaker with 60-watt 70.7v transformer, Altas IED Product No. PM8FA-**
   b. ** to be replaced with the proper alphabetical characters that depict the device color. Coordinate color with the Project Architect prior to submittal and procurement.
4. Surface mount speaker/horn:
   a. Surface mount wide-angle loudspeaker with multitap line matching transformer. Quam Product No. H16/SVP
   b. Provide recessed back can for each speaker. System installer to coordinate backbox rough-in with the project's electrical sub-contractor.
5. Recessed Vandal proof wall mounted paging horn:
   a. Atlas Sound APF-15T with 193-8-6 square recessed back box and VP161-APF aluminum alloy grille, white finish, neoprene gasket.

D. Remote Source Output Volume Control:
   1. Rack mounted in remote source rack. Provide line level volume control of output of each remote source device. Label each volume control for each output device.

E. Wall Mounted Volume Control (Attenuators)
   1. Attenuator(s) shall be Atlas Sound AT Series Model AT10-PA auto transformer or approved equal. The power rating shall be 10W and total attenuation shall be 33dB. Attenuation per step for AT10-PA shall be 8 steps of 3dB and 6dB each for the last two positions. Attenuator shall be a step type control with a positive off position. There shall be no stop between the maximum and off positions. Switch shall have silver plated contacts to eliminate noise and contact loss. All terminations must be made via a removable terminal block. Unit(s) shall be supplied with stainless steel single gang face plates (with dial scale to indicate attenuator position).

F. Secondary Clocks:
   1 General
      a. Provide secondary clocks at locations shown on drawings.
      b. Digital Clock: Microprocessor-controlled unit with red LED digital time display of hours and minutes.
         1) Digital Clock: Microprocessor-controlled unit with red LED digital time display of hours, minutes, and seconds.
         2) Display Height
            i. Classroom: 2.5-Inch
            ii. Corridor: 4-Inch
            iii. Cafeteria: 4-Inch
            iv. Gymnasium: 4-Inch
         3) Display Format: Selectable between 12-hour (with "PM" indicator

on LED display) and 24-hour formats.

c. Connections for Power and Correction:
   1) Wired synchronous connection to master clock for both operating power and correction.

d. Clock Circuit Power Booster
   1) Transformer power supply, mounted in steel cabinet with hinged door, and having fuse-protected input and output circuits.

e. Back Boxes
   1) Box and cover plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting device, unless otherwise indicated.

f. Guards
   1) Formed-steel wire, shaped to fit around guarded device, with 1-inch (25-mm) maximum clearance.
   2) Mounting Provisions: Fixed tabs welded to guard and arranged for screw attachment to mounting surface.
   3) Finish for Indoor Devices: Clear epoxy lacquer over zinc plating or powder coat painted finish.

PART 3 – EXECUTION

3.1 MATERIALS

A. Wire: Wire shall be #22 gauge at a minimum. Wire for communications system shall consist of 2 twisted pairs #22 solid copper under plenum jacket. No splices are permitted except in approved junction boxes. All terminations shall be made on telephone type punch blocks or at specified devices. Display, speaker, and specialty cables shall be as required for best operation under manufacturer recommendations.

B. Jacks: All station device terminations (except speakers) shall be terminated on USOC standard modular jacks. Jacks for wall mounted telephones shall have lugs for securely attaching the instrument to the wall.

C. Backboards: Provide 4 feet x 8 feet plywood backboards for mounting of system cross connect field. Mount as shown on the plans. Provide Modular Termination backboards with 110 type terminal blocks as required to terminate all cables. Provide Distribution and cross connect backboards equal to AT&T 110 Series for all cross connect wiring.

3.2 INSTALLATION

A. All work under this section shall be performed by persons having specific familiarity with telephone, data and sound system installation. Upon request the contractor shall submit resumes, references or other corroborating documentation, to the engineer to confirm the contractor's capabilities and experience.

B. Grounding: Except were specifically indicated otherwise, all exposed non-current carrying metallic parts of the communications system shall be grounded. This may be accomplished via a driven ground rod, cold water pipe or building power ground. If the building power ground is used, a separate ground conductor shall be used from the equipment to the grounding grid. All grounding shall be done with #6 solid copper wire or larger. The contractor shall use every effort to insure system stability and safety.

C. Wiring: A comprehensive, documented communications wiring system is to be installed. Wiring is to be identified by room number, segregated, neatly laced, and terminated on telephone type punch blocks. Back boards and cross connect fields shall be neatly organized as to function. (ie: intercom, telephone stations, data network etc.) All termination points are to be labeled with function. Data cables shall be certified as usable and checked using the cable certification sheet. Data cables shall be labeled as per the data identification

scheme.

D. Speaker Wattage Taps: Tap all classrooms at ½ watt. Tap Corridor Speakers for 1 watt, Outside Horns 3.3 watts, Tap Speakers in High Ceilings (15FT +) at 4 watts. Rest rooms ½ watt.

3.3 TESTING AND TRAINING

A. Prior to connection of any terminal equipment all cables shall be tested as per REA spec. PC-4. Cables shall be tested for Opens, Splits, Crossed Pairs, Shorts to Ground and Shield Continuity. All defective cabling is to be replaced prior to device hook-up.

B. Upon completion of the installation the contractor shall test each room station speaker, handset or call switch for proper operation. All telephones, programming and functions are to be tested for proper operation. All emergency and program functions are to be tested. Any malfunction shall be corrected prior to final acceptance.

C. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming, station use and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals specified in part 1.04 above.

END OF SECTION

SECTION 28 0100
OPERATION & MAINTENANCE MANUALS OF ELECTRONIC SAFETY & SECURITY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer’s operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system’s final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant’s stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System’s O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:

1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant’s stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Low Voltage Wire and Cable
12. Schedule of ESS Equipment
13. Schedule of ESS Field Devices
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules
16. Other required operating and maintenance information that are complete.
17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project’s Technology Consultant.

1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project’s Technology Consultant shall review the manuals for completeness within 15

days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
   1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
   2. Minimum ring size: 1"; Maximum ring size: 3".
   3. When multiple binders are used, correlate the data into related groupings.
   4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format:
      a. Size: 8-1/2" x 11"
      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 flyleaf 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.

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 / normal operating instructions
      2) Regulation, control, stopping, shut down and emergency instructions
      3) 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. Manufacturer's printed operating and maintenance instructions.
   e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Items recommended to be stocked as spare parts.
   f. Schedule of low voltage wire and cable
   g. Schedule of ESS equipment
   h. Schedule of ESS field devices
   i. Each Contractor's coordination drawings.
      1) As installed color coded wiring and cabling diagrams.
   j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   k. 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 27.
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.

END OF SECTION

SECTION 28 0500
ELECTRONIC SAFETY AND SECURITY BASIC MATERIALS, METHODS, & GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28 Electronic Safety and Security.

B. Applicable provisions of this section apply to all sections of Division 28, Electronic Safety and Security.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.

1. Division 26 in its entirety.
2. Division 27 in its entirety.
3. Division 28 in its entirety.

D. The entire drawing and specification package apply to the work specified in the Electronic Safety and Security 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.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:

1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*

17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

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 a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.

C. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
   a. Licenses, as applicable to the system being installed
   b. Manufacturer's Certifications
      1) Firm Certification
      2) Installer Certification
      3) Programmer's Certification
      4) System Designer Certification.

1.5 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 Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

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 Consultant in writing, shall be performed or furnished. In the case that 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. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on 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.

F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.

H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project’s consultant.

I. 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 project’s consultant 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.

J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer’s shop drawings and product data submittals shall represent a complete system and documents accepted by the project’s consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project’s Technology Consultant and the Owner.

1.6 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, ordinances, and standards; 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 closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. 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 Consultant. The Consultant 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.

E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3” beyond the finished surface. In pipe chases, they shall extend 8” inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio.1/2 inch greater than outside diameter of the conduit.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final connections to all ESS equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or

imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

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.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum

CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet *(Now referred to as TR)*
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.16 QUALITY ASSURANCE

A. Equipment Standards:
   1. System and all components shall be brand new stock from manufacturer.
   2. All electronics shall be 100% solid state.
   3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
   At the time of Proposal, the Contractor shall:
   1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
   2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
   3. Hold all legally required state registrations to meet local requirements for submittal drawings.
   4. Have a local office within fifty (50) miles of the project site staffed with factory

trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.

5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 1 and the following.

B. Requirements:

1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014+ / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014+ dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
   3. Three sets of blue or black-line prints of each contract as-built drawing.

C. 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 conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground ESS raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all ESS equipment in and outside of the building.
11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.26 OPERATING TESTS

A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 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.

2.3 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.

2.4 MANUFACTURE'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper Electronic Safety and Security 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 Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, 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 Consultant.

2.5 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.

2.6 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.

B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.

C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

A. All materials required for the installation of the Electronic Safety and Security 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 installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a

junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

N. The installation shall be performed in a professional manner.

O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmeter (megger) and a reading of greater than 20 megohms shall be required to

successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.

. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
2. A black-white-black 3-layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
   a. Identifying nameplates shall have 1/2-inch high, engraved letters.
3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public,

tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.

C. Time to be allocated for instructions.
   1. Minimum of 12 hours dedicated instructor time
   2. 4 hours on each of 3 days
   3. Additional instruction time for specific systems as specified in other Sections.

D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, troubleshooting, 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 training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

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, and 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 Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this 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 shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.

1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.13 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

A. 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.

B. 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 Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant 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 no additional cost to the Owner or the Consultant.

C. 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.

D. 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 Consultant.

3.15 EXISTING SYSTEM TESTING

A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 28 umbrellas, as identified in the Division 2 of the Construction Specifications Institute (CSI) current Master Format7 Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.

B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.

C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.

D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect’s judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer’s factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide

the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
   1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
   2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
   3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
   1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
   2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
   3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
   1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
   2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete

detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
   1. System Operations and Maintenance Manuals
   2. System Test Reports
   3. As-Built Drawings

3.19 NOTICE OF COMPLETION

A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 0507
SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data

D. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
   1. Actual ESS equipment and components to be furnished.
   2. NEC working space and NEC access to NEC working space.
   3. Relationship to other equipment and components and openings, doors and obstructions
   4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Verify location of ESS station devices and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to

specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
   2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number

3. Contractor's name, address and telephone number
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
a. Contractor
b. Subcontractor
c. Supplier
d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
   2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
   1. Low Voltage Wire
   2. Electronic Access Control and Intrusion Detection
   3. Electronic Surveillance
   4. Fire Detection and Alarm

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION

SECTION 28 0510
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.
B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
    1. Field conditions.
    2. Condition of installation.
    3. Quality of workmanship.
    4. Start-up of equipment.
    5. Testing and adjusting of equipment.
B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 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 where possible.
D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
    1. Rough-in

2. Finish with all appurtenances in place
3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 28 0550
FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson.

B. 3M (Minnesota Mining Manufacturing).

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 28 1000
ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
   1. Conditions of the Contract
   2. Division 1
   3. Division 26
   4. Division 27
   5. Division 28

1.2 WORK INCLUDED

A. Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards.

B. 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.

C. Security system devices indicated are for reference and coordination purposes only. 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.

D. The system shall include security for all access into building, including but not limited to the following:
   1. Door Hardware (as specified herein and/or in Division 08, door hardware)
   2. Control Panels
   3. Power Supplies.
   4. Interconnection of panels.
   5. Installation of new devices.
   6. Card reader.
   7. Magnetic locking hardware
   8. Request to exit devices
   9. Door position sensors
   10. Lockdown and Lockout Buttons
   11. Audio Intercom Systems
   12. Licensing
   13. All additional material, hardware, and labor required for a fully functional, turnkey system

E. The contractor shall connect each controller to the ACS Management System.

F. Access Control Programming:
   1. Access Control contractor to provide basic system programming to ensure proper system functionality and correct installation.
   2. Custom programming to be performed by District vender Pref-Tech ONLY. Programming cost for access control to be included in the general contractor's contract. Installing contractor shall coordinate with district vendor.

G. Licensing: The contractor shall NOT utilize any of the owner's existing licensing for this scope of work. All licensing shall be provided by the contractor, no exceptions. Including, but not limited to the following:
   1. Portal Licensing
   2. Controller Licensing
   3. Wireless Licensing

4. Video Management Software Integration Licensing

H. Contractor to refer to specification 08 71 00 Door Hardware. Provide and install all hardware specified to be provided by the “Access Control Contractor”, “Security Installer”, “Division 28”, or any variation thereof.

I. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer’s shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project’s Technology Consultant and the Owner.

1.3 REFERENCES

A. Code of Federal Regulations (CFR).

B. Institute of Electrical and Electronics Engineers (IEEE):
1. 802.3 Ethernet Standards.
2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.

C. International Electrotechnical Commission (IEC).

D. International Organization for Standardization (ISO):
1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).

E. Federal Communications Commission (FCC):
1. FCC Part 15 – Radio Frequency Device

F. Underwriters Laboratories (UL):
1. UL294 – Access Control Systems Units

G. Electronic Industries Alliance (EIA)
1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems

H. Federal Information Processing Standards (FIPS)
1. Advanced Encryption Standard (AES) (FIPS197)
2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
3. Personal Identity Verification (PIV) of Federal Employees and Contractors

I. Homeland Security Presidential Directive 12 (HSPD12)

K. National Fire Protection Association Standards:
1. NFPA 70 - National Electrical Code
2. NFPA 72 - National Fire Alarm Code
3. NFPA 101 - Life Safety Code

M. RoHS compliant

N. SIA AC-01-1996.10 - Access Control - Wiegand

O. Local & State Building Codes

P. Requirements of Local Authorities having Jurisdiction

Q. Requirements of American Disabilities Act (Public law 101-336).

R. Texas Accessibility Standards (T.A.S.)

S. 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. The installing contractor shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm 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.
5. 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.
6. 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.
7. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.
9. Contractor must be a current integrator of solution in the closest 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 AND CLOSE-OUT

A. Product Data:

1. Within fourteen (14) days of Notice to Proceed, the 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 system equipment, power supplies, cable, termination components, cable supports, cable labels, field 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 submitted.
    c. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
    d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system 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.

e. 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) Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
   2) Installer Certification: This certification 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.
   3) Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system

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 system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
      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 all control equipment and remote power sources
         2) Locations of all field devices and outlets
         3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
         4) Location of sleeved wall and/or floor pass-thru
         5) Size of sleeve at each location installed
         6) Quantity of cable passing through each sleeve
         7) Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
      c. Drawing Compliance: A letter shall be provided stating that the system 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 approved by the project's technology consultant.

C. Close-out Procedures:
   1. For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the

name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:

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 and 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 system from the original approved shop drawings.
g. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
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. Any 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. 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. Provide a video copy of the training session as well as all sign in and training sign off sheets
m. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. Contractor shall provide one complete floor plan sheet at each panel location.

1.6 DEFINITIONS

A. Abbreviations:

1.	ACS	Access Control System
2.	VMS	Video Management System
3.	NVR	Network Video Recorder
4.	IDS	Intrusion Detection System
5.	GUI	Graphical User Interface

6.	IP	Internet Protocol
7.	CR	Card Reader
8.	DS	Door Station
9.	MS	Master Station
10.	PIR	Passive Infrared Sensor
11.	LD	Lockdown
13.	LO	Lockout
14.	MDF	Main Distribution Frame
15.	IDF	Intermediate Distribution Frame

B. Definitions:

1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.
6. Alarm: A signal that indicates a problem.
7. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
8. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
9. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
10. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
11. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
12. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
13. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
14. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
15. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
17. Duress: Forcing a person to provide access to a secure area against that person's wishes.
18. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.

19. Integrated lockset: An integrated, intelligent locking solution that typically runs on batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.
20. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.
21. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
22. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
23. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
24. Video Management System: An enterprise-class video management and storage solution

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
B. Handling: Handle materials to avoid damage.

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 recommended limits.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

2.1 Reference Attachment ‘A’ of this specification for supplemental scope and product material list as it relates to the project and the Owner standards

2.2 MANUFACTURERS

A. Approved Manufacturers:
   1. Genetec, Inc.
B. Requests for substitutions will be considered in accordance with provisions of Division 1. In the absence of direction by Division 1, substitution request must be submitted no less than ten (1) business days from the time of proposal.

2.3 SERVERS AND USER INTERFACE

A. Servers and Unser Interfaces are existing to remain. The system installer shall coordinate the installation of all new equipment and/or existing equipment that is affected by the project's scope. All equipment shall be modified and/or added in compliance with the existing systems parameters. The system installed shall provide and additional equipment to furnish a complete expansion of the system as shown on the project drawings, access control schedule, details, and legends.

2.4 ACCESS CONTROL SYSTEM (ACS)

A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:

1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
   a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
   a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
3. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
   a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
   b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
   a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.
5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.

6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import / export of employee data.
8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
14. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.

B. Open Architecture: The access control system infrastructure will be based on an open architecture design capable of supporting multiple access control hardware manufacturers and integrate with multiple non-proprietary network processors, controllers, interface modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

C. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.

D. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be

designed to support all of the following:
1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
2. Direct-connected RS-232 and RS-485 communication cabling.
3. Dial-up modem connection using a standard dial-up telephone line.

E. Provide local communication port at each panel for local configuration of system with laptop.
F. Locate all main control panels in MDF and IDF rooms of each building.
G. Provide 120v at all controller and power supply locations.
H. Provide and transfer all required licensing to the owner.
I. Provide local communication port at each panel for local configuration of system with laptop.

2.5 ACCESS CONTROL PANEL HARDWARE

A. Enclosure:
1. Typical 4-Door System Enclosure:
a. Power supply board 75W, 6A/12V or 3A/24V | Secondary voltage power supply, 5-18V adjustable @ 4A max, class 2 power limited output | Eight output smart distribution module, fused at 3A per output | Four port network monitoring module | Enclosure, Size with backplate to accommodate the specified hardware.
2. Typical 8-Door System Enclosure:
a. Power supply board 150W, 12A/12V or 6A/24V | Secondary voltage power supply, 5-18V adjustable @ 4A max, class 2 power limited output | 16 auxiliary DC outputs class 2 power limited at 2.5A per output | Eight output smart distribution module, fused at 3A per output | Four port network monitoring module | Enclosure, (23W x 32H x 6.5D) with backplate to support the mounting of the specified hardware.
4. Power supplies shall be connected to the Owner's network, allowing for remote management, including but not limited to the following:
a. Allow the user to connect any network connected power within a local network or via the internet from any remote location.
b. Allow for all connected power supplies to be monitored for status and firmware revision on a single screen.
c. Allow batch firmware updates to maintain the latest feature sets and cybersecurity standards.

B. System Control Processor
1. Intelligent two portal two reader combination system controller with 10/100Base-T Ethernet connectivity and dual reader interface module, minimum of 6MB RAM, 1 RS-232/485 host port, with a secondary RS-232/485 host port for redundancy, 1 two wire RS-485 channel for communication to a maximum of 31 I/O modules, support for up to two magstripe or Wiegand readers. Includes a minimum of two (2) door contacts, two (2) request to exit inputs, two (2) door strike relays, four (4) programmable inputs and two (2) output relays

C. Door Controllers
1. Two Portal Two Reader interface module - support for up to two magstripe or Wiegand readers. Includes: two door contacts, two requests to exit inputs, two door strike relays, four programmable inputs and four output relays

D. Input Monitor Modules
1. 16 normally open or closed, supervised or non-supervised inputs for monitoring vital alarm points or for providing elevator floor selection control. Includes: 2 programmable output relays and (32) 1K ohm resisters for supervisory wiring

E. Output Control Modules
1. 16 programmable output relays with the option of being configured as fail-safe or fail-secure. These relays support "On", "Off" or "Pulse" modes for a variety of

applications such as elevator control or any device requiring dry contacts.

F. System Back-Up Battery
   1. Contractor to backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.

G. RS-485 Communications Multiplexer:
   1. Provide a multiplexer at each control board that is utilizing a RS-485 communication channel to panel interface modules and/or RS-485 type door hardware. There shall be no more than eight (8) RS-485 connections made on a single multiplexer.

2.6 FIELD DEVICES

A. General
   1. Coordinate with door hardware and access control schedule as to whether each access control portal is wireless or directly connected to a control panel. Provide all Controllers, Sub-Controllers, and licensing as required to connect all card reader locations shown on plan.

B. Card Readers
   1. Provide card readers as shown on the floor plans, access control schedule, and access control details.

C. Credentials
   1. Coordinate Facility Code, External Start Number, and Internal Start number with the Owner prior to procuring credentials.

D. Miscellaneous Devices
   1. Provide the following devices as designated per the project floor plans, access control schedules, and access control details:
      a. DP/DT Door Position Sensors (Door Contacts)
      b. PIR Motion Request to Exit Sensor
      c. Lockdown Buttons
      d. Door Release Buttons
      e. Video Intercom Door Stations
      f. Video Intercom Master Stations

2.7 WIRING

A. Ethernet cabling shall be provided by the Structured Cabling System Installer. In the event that there is not SCS installer on the project, cabling shall be provided and installed by the Access Control System Integrator and shall comply with the Division 27 Structured Cabling specification.

B. Conventional access control cable shall be a jacketed composite cable. The minimum conductor requirement shall be as follows:
   1. Standard
      a. Lock Power: 4-conductor, 18AWG, shielded
      b. Card Reader: 6-conductor, 22AWG, OA shielded
      c. Door Contact: 2-conductor, 22AWG, shielded
      d. Request to Exit/Spare: 4-conductor, 22AWG, shielded
   2. Extended Distance
      a. Lock Power: 4-conductor, 16AWG, shielded
      b. Card Reader: 6-conductor, 18AWG, OA shielded
      c. Door Contact: 2-conductor, 18AWG, shielded
      d. Request to Exit/Spare: 4-conductor, 18AWG, shielded

C. Wire scheme and conductor quantity shall be as required by the manufacture’s specifications. Contractor to provide and install shielded cable as required.

D. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installing contractor

shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.

E. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installing contractor shall provide and install all conduit required.

F. Coordination with the Division 26 contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

G. All systems shall be connected to a dedicated circuit and on an emergency power source if available.

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.

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:
      1) Panduit
      2) Arlington
      3) Caddy
      4) Support system shall be 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. Tie wraps 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 ensure 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 SYSTEM ZONING AND PARTITIONING

A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.

3.4 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 and the project’s Technology Consultant 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.

3.5 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.

Attachment 'A'

Project Specific Scope of Work and Equipment List

PART 1 – PROJECT SCOPE

1.1 DESCRIPTION OF WORK

A. This project consists of the provision and installation of a complete and functional Access Control System (ACS) as required to furnish controlled access and access detection to all controlled portals identified on the project drawings and associated Access Control Schedule. This project is a renovation and addition of the following campuses, for Humble Independent School District:
1. Creekwood Middle School - 3603 W Lake Houston Pkwy, Kingwood, TX 77339
2. Riverwood Middle School - 2910 High Valley Dr, Humble, TX 77345

B. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the ACS installer, unless specifically stated otherwise.

C. Access Control Programming
1. Access Control contractor to provide basic system programming to ensure proper system functionality and correct installation.

2. Custom programming to be performed by District vender Pref-Tech ONLY. Programming cost for access control to be included in the general contractor's contract. Installing contractor shall coordinate with district vendor.

PART 2 – EQUIPMENT LIST

2.1 The ACS installer shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Security Consultant.

2.2 MATERIAL LIST

MFR	DESCRIPTION	PRODUCT NUMBER	NOTES
Hammond	Service Can – Junction Box	CHK010104	Wires to be connected by 12 lug terminal strip only. No wire nuts or connectors. Can located above door.
Eaton	12 Lug Terminal Stri[	TB-100-12	
Mckinney	15' wire harness	QC-C1500P	Run from service can to door frame
Life Safety Power	16-door system enclosure	FPO150/250-3D8P2M8NL4E8M2/T16-A	
Enersys	12V 7 AMP Battery Backup	NP7-12	Backup panels
Gentec	IP Intelligent Controller	Synergis Cloud Link	
Mercury	Intelligent Controller (2 Rdrs, 8 Inputs, 4 Outputs	LP1502	

Mercury	Dual Card Reader Interface	MR52-S3	
STI	Blue Indoor Only Flush or Surface w/ Horn Key-to-Reset (Illuminated) Stopper Station with "LOCKDOWN" Label English	SS24A2LD-EN	Lockdown must kill power to doors with and without network communication.
Axis	Network Video Intercom Door Station, exterior/interior, mullion mounted	A8105-E	
Axis	Dual Audio input main unit.	F44	One per security vestibule.
Axis	Recessed dome for discreet surveillance.	F4005-E	4 cameras per F44.
Schneider Electric	Remote Door Release Contact Block	ZBE101	Provide one for each door with remote door release capabilities.
Schneider Electric	Remote Door Release Push Button	ZB5AA3	Provide one for each door with remote door release capabilities.
Schneider Electric	Remote Door Release Polycarbonate Enclosure	XALD0#CUST01	#' to be replaced with a numeric value depicting the enclosure size required to accommodate the quantity of remote door release button installed.
Bosch	Rex motion device	DS150i	Should be installed on all double leaf exits to detect exit on non card reader door.
Edwards Signaling	Surface Mount Aluminum Housing armored cable contact, DPDT, Wide Gap, 1 ½" Gap Size, Double Pole Double Throw	2507AD-L	Equivalent surface mount, double pole double throw will be acceptable.
HID	Access Cards	iClass Prox Card	13.56 MHz Combination Contactless Smart Card and Proximity card.
Sargent	Card Readers	SELP10	If discontinued provide manufacturer recommended replacement.

Norcon	2-way Talk-Thru Electronic Communication System	TTU® -1X Series	Provide and install one (1) at each Reception talk-thru window
Belden	Access Control Composite Cable, Purple in Color, Standard Distance	658AFJ	or equivalent as manufactured by Tappan
Belden	Access Control Composite Cable, Purple in Color, Extended Distance	638AFJ	or equivalent as manufactured by Tappan
Belden	2C/18AWG BC; CMP; Unshielded; LSPVC, purple	6300UE 0071000	or equivalent as manufactured by Tappan
Belden	4C/18AWG BC; UnShielded; Plenum-CMP; LSPVC; purple	6302UE 0071000	or equivalent as manufactured by Tappan
Belden	6C/18AWG BC; Unshielded; LSPVC, purple	6304UE 0071000	or equivalent as manufactured by Tappan

*ALL SYSTEM WIRING SHALL BE PURPLE IN COLOR.

END OF SECTION

SECTION 28 1500
INTRUSION DETECTION SYSTEM – EXPANSION OF EXISTING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install a fully functional intrusion detection system which 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.

B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system as specified. The Contractor shall provide all security system devices required for complete corridor perimeter coverage acceptable to all governing authorities.

C. The system shall include intrusion for all egress corridors in the building.
   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
   4. Interconnection of security panels
   5. Installation of new security devices
   6. Full coverage of all egress corridors
   7. Preconstruction meeting with Owner's personnel, installing technician and project superintendent

D. The system shall be wired as a Class B system for all circuits.

E. Scope of work includes expanding the existing intrusion system at Creekwood Middle school and Riverwood Middle school for Humble ISD. In addition area new devices and wiring will be required as shown on the drawings. All new devices shall be compatible with existing head end. In Renovation areas existing devices shall be rewired in place or in their new location. Reference drawings for more scope information and device locations.

1.2 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

A. Governing Authorities:
   1. UL864 – Control Units System (L, CS, -A, M, SS, WF)
   2. UL1610 – Central Station Burglar Alarm Units
   3. UL609 – Local Burglar Alarm Units
   4. UL365 – Police Station Burglar Alarm Units

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. Local Accessibility Standards

G. State Insurance Code.

1.3 QUALITY ASSURANCE

A. Contractor Qualifications:
   1. The installing contractor shall be the authorized representative of the Security Alarm 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 five years.

2. The installing contractor shall be licensed by the State as a security services contractor to design, sell, install, and service security alarm systems.
3. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
4. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least five (5) years.

1.4 SUBMITTALS

A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
1. Complete point-to-point wiring diagrams.
2. Riser diagrams.
3. Complete floor plan drawings locating all system devices.
4. Factory data sheets on each piece of equipment proposed.
5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
6. Complete system bill of material.
7. 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Match Existing

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 ¾-inch 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, at 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. Telephone Cable: Provide a 4 pair Category 6 telephone cable from the Master Control Panel to the Telephone Equipment Room.
I. Each motion sensor shall be an addressable zone.
J. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring in D-rings or J-hooks. Support D-rings or J-Hooks. Cable shall be bundled on a maximum of 2-foot-6-inches. D-rings or J-hooks shall be secured to the structure at a maximum of 5-foot on center. Bundling shall be with plenum rated cable ties. Cable shall not be directly attached to building structure.

3.2 SYSTEM OPERATION

A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
   1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
   2. A custom system alarm message shall be displayed on the LCD display. This display will show the alarm device location in plain English. Location and partition custom messages shall be field programmable.
   3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.

3.3 SYSTEM ZONING AND PARTITIONING

A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.
B. All zoning/device locations shall be field programmable.
C. Input control zones shall be as indicated on the drawings.
D. The zoning shall at a minimum partition in the following ways, coordinate all requirements with owner prior to final programming:

3.4 COMMISSIONING THE SYSTEM

A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.
B. A state licensed and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.
C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Any items found not properly installed or non-functioning shall be replaced or repaired and retested.
D. The installing contractor shall provide a complete written report on the functional test of the entire system. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed burglar alarm superintendent responsible for supervising the final system test and checkout.
E. The installing contractor's burglar alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main burglar alarm control panel.

F. The testing and acceptance shall be performed within 30 days after the burglar alarm installation is completed. The test shall be performed by a minimum of two qualified burglar alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all burglar alarm system equipment shall include the following:
   1. Burglar alarm control equipment: a visual and functional test of the burglar alarm control and auxiliary control equipment.
   2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
   3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
   4. Indicators shall be tested to ensure proper function and operation.
   5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
   6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
   7. Burglar alarm peripheral devices; All burglar alarm peripheral devices shall be functionally tested, and the location and testing information recorded for each device.
   8. Manual initiating devices:
      a. Each manual alarm station at each keypad shall be functionally tested for alarm operation.
      b. Each manual alarm station at each keypad shall be functionally tested for proper wiring supervision.
   9. Automatic initiating devices:
      a. Each automatic initiating device shall be activated in accordance with manufacturer’s instructions to ensure proper operation.
      b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
      c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
   10. Alarm signaling devices:
      a. Each alarm signaling device shall be tested and decibel reading taken at 10-feet from the device and recorded to ensure proper operation.
      b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
      c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
      d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
   11. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all burglar alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory trained representative.

G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance be provided by the Owner. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

3.5 EQUIPMENT IDENTIFICATION

A. Each piece of equipment shall be provided with a permanently engraved or embossed or silk screen identification tag. The tag shall include the following information:
   1. Name of manufacturer.
   2. Manufacturer's equipment description.
   3. Serial number and model number.
   4. Voltage and current rating.

3.6 SPARE PARTS AND TOOLS

A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage in a Contractor provided cabinet located in the building where directed by the Owner. Provide a wall mounted cabinet; factory finished, keyed like the burglar alarm control panel, and located in the emergency control center or as directed by Owner, Architect.

B. Spare Parts:
   1. Six spare fuses of each size used in the system
   2. Six spare detectors of each type in the system
   3. Spare system keys (6) of each
   4. Two copies of the final software programmed into the burglar alarm system.
   5. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.

C. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 GRAPHIC FLOOR PLANS

A. Provide color coded floor plan detailed with room names, graphic room numbers and adequate information to direct people to the burglar alarm devices in alarm with Non-fading floor plan media.

B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All burglar alarm devices located to correspond with the annunciator.

C. The floor plan shall be solvent welded in acrylic plastic.
   1. Mount in an extruded aluminum frame next to the main burglar alarm control panel.

D. Post minimum 11x17 size drawing, color laminated As-Built of system identifying all devices, key pads, panels and partitions on the wall near main control panel.

3.9 ADDITIONAL REQUIREMENTS

A. The contractor is to ensure all areas of the egress corridors are covered with motion detectors.

B. Provide all accessories required for off-site monitoring. Coordinate with Owner for appropriate off-site monitoring service.

C. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) motion detection devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
D. Provide surface mount door contacts on all outside odors and roof hatch. Do not wire intrusion detection devices inside door frames.
E. Do not place guard covers over motion detectors except in harsh environment such as gyms.
F. Alarm systems must have a dedicated 120 VAC circuit on an emergency power panel.
G. Intrusion detection shall be one system for entire building, armed and disarmed from any keypad in the building.
H. The inside hallways shall have motion detectors where indicated or required to eliminate any dead zones.

3.10 SUBSTANTIAL COMPLETION

A. Final acceptance of the Burglar Alarm System by the Owner, local code authorities and Occupancy Permit has been issued.

3.11 WARRANTY

A. The new components and installation of the expanded burglar alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification.
B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
E. Provide a certified burglar alarm test of the complete system at the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner.
F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of “As-Built” drawings and schematics of all equipment.

3.13 TRAINING

A. Provide training course to all security personnel assigned by Owner’s Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
B. Provide a video of the training program to the Owner’s Representative to be used for periodic refresher course, training of the local security department and for training of new employees.
C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.

D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

3.15 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 4600
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
   1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
   2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
   3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
   4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.

B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

A. Divisions 22, 23 and 26

B. Sprinkler Systems

C. Elevators

D. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

A. National Fire Protection Association (NFPA):

1.	NFPA 13	Systems, Installation
2.	NFPA 17	Dry Chemical Extinguishing Systems
3.	NFPA 70	National Electrical Code
4.	NFPA 72	National Fire Alarm and Signaling Code.
5.	NFPA 80	Fire Doors and Fire Windows
6.	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems.
7.	NFPA 92A	Smoke Control Systems
8.	NFPA 101	Life Safety code.
9.	NFPA 105	Smoke Control Door Assemblies
10.	NFPA 2001	Fire Extinguishing Systems, Clean Agent

B. UL: Underwriters Laboratories, Inc.
1. 217 Single and Multiple Station Smoke Detectors.
2. 268 Smoke Detectors for Fire Protective Signaling Services.
3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
4 864 Transient protection
5. 1480 Speakers for Fire Protective Signaling Systems
6. UL Fire Protection Equipment Directory.
7. UL Electrical Construction Materials Directory.

C. Factory Mutual P7825 Approval Guide

D. American National Standards Institute (ANSI).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic Engineers (IEEE).

G. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.

H. Requirements of American Disabilities Act (Public Law 101-336).

I. Local Accessibility Standards

J. State Fire Marshall or Requirements of Local Authorities having Jurisdiction

K. State Insurance Code

L. International Building Code Adopted by Local Authority Having Jurisdiction

M. Local & State Building Codes

N. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.

B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.

C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.

D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.

E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.

F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.

G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.

H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.

I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.

J. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) 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 State Insurance Code.

K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Texas Board of Professional Engineers.

L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.

M. Material shall be new and in perfect condition when installed.

N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

O. Quality Control Assurance:
1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial listing shall not be acceptable.
2. All components of the fire alarm systems shall use the most current technology available.
3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.
4. All devices shall be tested and certified that they meet or exceed the “Service Life Expectancy Rating” as outlined by UL and NFPA.

1.5 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements

surrounding installation of the fire alarm system with all other trades.

B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.6 DEFINITIONS

A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
   a. The operation of a manual station.
   b. The operation of a fire suppression system switch.
2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

A. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.

B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).

C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
1. Name of Owner and Occupant
2. Date
3. Location, including street address.
4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
5. Device Legend
6. Input/output programming matrix

7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
8. Battery calculations
9. Notification appliance circuit voltage drop calculations
10. Floor Plan
    a. Floor identification
    b. Point of compass
    c. Correct graphic scale
    d. All walls and doors
    e. All partitions extending to within 15 percent of ceiling height
    f. Room descriptions
    g. Fire alarm device / component locations
        1) Signal notification devices
        2) Initiation devices
        3) Smoke control systems
        4) Initiation of automatic extinguishing equipment
        5) Doors that unlock or close automatically
        6) Zone verification for detection devices
        7) Fire/Smoke damper control
        8) Fire alarm panel location
        9) Fire alarm annunciators
        10) Control valves to Fire Protection System
        11) Duct smoke detectors
        12) Supervisory devices
        13) Elevator location
        14) Elevator recall system location
    h. Location of fire alarm primary power connections
    i. Location of monitor/control interfaces to other systems
    j. Riser locations
    k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
    l. Ceiling height and ceiling construction details
    m. Fire alarm system riser diagram
        1) General arrangement of the system, in building cross-section
        2) Number of risers
        3) Type and number of circuits in each riser
        4) Type and number of fire alarm components/devices on each circuit, on each floor or level
11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
    a. Identification of control equipment depicted
    b. Location(s)
    c. All field wiring terminals and terminal identification
    d. All indicators and manual controls, including the full text of all labels
    e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
    f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
12. Complete system bill of material of all hardware components.
13. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.

15. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
16. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
18. Indicate visual alarm device initial candela setting required for coverage.
19. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.

B. The Operation and Maintenance Manual shall consist of the following:
1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.9 AS-BUILT DRAWINGS

A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified

elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 OPERATIONAL INSTRUCTIONS

A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

1.11 WARRANTY

A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and emote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.

B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.

C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.

F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of “As-Built” drawings and schematics of all equipment.

G. All manufacturer’s warranties which extend past final completion shall be fully transferred to the Owner.

PART 2 - PRODUCTS

2.1C ACCEPTABLE MANUFACTURERS – CREEKWOOD MS

A. Existing voice evacuation fire alarm system is to be expanded. Reference drawings for more information

B. Manufacturers acceptable contingent upon Products' compliance with the specifications:
   1. Match Existing

2.1R ACCEPTABLE MANUFACTURERS – RIVERWOOD MS

A. Existing system is to be replaced.

B. Manufacturers acceptable contingent upon Products' compliance with the specifications:
   1. Notifier
   2. Silent Knight by a Farenhyt Dealer

C. Fire Alarm Communicator
   1. Teleguard TG-7FS, 5G LTE-M Cellular Communicator

2.2 SYSTEM DESCRIPTION

A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.

B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
   1. Alarm
   2. Trouble.
   3. Open
   4. Short
   5. Device missing/failed.

C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.

D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.

E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.

F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.

G. Auxiliary manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble.

H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.

I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.

J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate, and the audible trouble signal shall sound.

K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.

M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.

N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.

O. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.

P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.

R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.

S. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.

B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.

C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.

D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.

E. The following primary controls shall be visible through a front access panel:
1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
2. Individual red system alarm LED.
3. Individual yellow supervisory service LED.
4. Individual yellow trouble LED.
5. Green “power on” LED.
6. Alarm acknowledge key.
7. Trouble acknowledge key.
8. Alarm silence key.
9. System reset key.
10. Additional control buttons as directed by Owner.

F. Under normal condition, the front panel shall display a “SYSTEM IS NORMAL” message and the current time and date.

G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

H. The alphanumeric display shall provide the following information relative to the abnormal condition of a point in the system.
1. 40-character custom location label.
2. Type of device (i.e. smoke, pull station, water flow).
3. Point status (i.e. alarm, trouble).
4. Addressed device physical location to correspond to the actual graphic room numbers.

I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.

J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.

K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, “END of LIST”.

L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.

M. Alarm silencing:
1. Should the “Alarm Silence” button be pressed, all audible alarm signals shall cease operation.
2. Visual signals shall not be extinguished during alarm silence inhibit mode.

N. System reset:
1. The “System Reset” button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.

O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
1. HVAC - Bypass
2. Indicating appliance circuits bypass
3. Auxiliary relays points bypass
4. All other input/output points bypass.
5. Additional control buttons as directed by Owner.

P. The following status data or their equivalent shall be available:
1. Primary state of point.
2. Device, PID and card type information.
3. Current priority of outputs.
4. Disable/enable status.
5. Verification tallies of initiating devices.
6. Automatic/manual control status of output points.

7. Acknowledge status.
8. Relay status.

Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.

R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced; the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.

S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
2. LED testing.
3. Alarm, trouble, and abnormal condition listing.
4. Enabling and disabling of each monitor point separately.
5. Activation and deactivation of each control point separately.
6. Changing operator access levels.
7. Walk test enable.
8. Running diagnostic function.
9. Displaying software revision level.
10. Displaying historical logs.
11. Displaying card status.
12. Point listing.
13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
    a. All points list by address.
    b. Monitor point list.
    c. Signal list.
    d. Auxiliary control list.
    e. Feedback point list.
    f. LED/switch status list.
    g. Additional control buttons as directed by Owner.
14. Fire Drill:
    a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
    b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
    c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper- and lower-case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.
17. The system shall be capable of being tested by one person. The actuation of the “enable walk test” program at the fire alarm control panel shall activate the “Walk Test” mode of the system, which shall cause the following to occur:
    a. The remote monitoring circuit connection shall be bypassed.

b. Control relay functions shall be bypassed.
c. The control panels shall show a trouble condition.
d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
e. The panel shall automatically reset itself after signaling is complete.
f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.

18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.
a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual "*" in the display.
b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
c. Should an invalid code be input, access shall be denied.
d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
e. The following keys/switches, or their equivalent shall have access levels associated with them:
Set time/date.
Manual control
Disable/enable
Clear historical alarm log
Clear historical trouble log
Walk test
Change alarm verification
f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
Alarm Silence
System Reset
Acknowledge

19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a

combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.

21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
    a. The following Historical Alarm log events shall be stored:
        Alarms
        Alarm acknowledgment
        Alarm silence
        System reset
        Alarm historical log cleared
    b. The following historical trouble log events shall be stored:
        Trouble conditions
        Supervisory alarms
        Trouble acknowledgment
        Supervisory acknowledgment
        Alarm verification tallies
        Walk tests results
        Trouble historical log cleared
23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED "ON" indicating the off-normal condition.
26. Activation of an auxiliary bypass key shall override the selected automatic functions.
27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
28. RS-232-C output: the fire alarm control panel shall be capable of operating remote generic consumer type printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote display and printer. Data amplifiers shall be used to increase data line distance when required.
29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.

T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.

U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.

1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
3. Each power supply shall be monitored and have an individual address.

V. Digital Fire Alarm Communicator:

1 Two line primary and secondary telephone line connections
2. Automatically seizes telephone line.
3. Automatic verification between panel and receiving station.
4. Transmits common trouble and supervisory conditions.
5. Dialer status LED.
6. Multiple communication formats including Ademco Contact ID.
7. Dual tone multi-frequency (DTMF) or Pulse modes.
8. Programming password protected.
9. UL approved.

W. IP Internet and Digital Cellular Communicator:

1. UL 864 listed
2. Supervise IP Ethernet connection every 90-seconds or less
3. Upload/Download capable
4. Transmit all signals and information from the DTMF communicator

X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of “Day-Night” automatic sensitivity adjustments.

Y. Control Switches:

1. Acknowledge/step Switch
2. Signal Silence Switch
3. System Reset Switch
4. System Test Switch
5. Lamp Test

Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In

addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

AA. Emergency voice alarm communication system:

1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
7. An alarm condition shall cause an audible signal and a red LED to activate. A

Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.

8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

BB. Notifier ONYXWorks command interface gateway for remote monitoring and control:

1. Intelligent gateway interface for HISD's remote ONYXWorks fire monitoring workstation. Interface gateway shall facilitate complete monitoring and control of a NOTI-FIER-NET network, fire alarm panel software and programming and network diagnostics.

2.4 FIELD DEVICES

A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.

B. Visual Signals:

1. Strobe lights shall be of the electronic flashing strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
2. All wall mounted visual devices installed in gymnasiums, corridors, kitchen preparation and serving areas, vocational shops, athletic/drill team training rooms, student restrooms/toilets, cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1221E Series. Provide enviro kit for locations where dampness, water or dust is present.

C. Combination Alarm Signal and High Intensity Visual Signals:

1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
2. All combination audio / visual devices mounted in student toilets / restrooms, and student locker / dressing rooms shall have a protective cover. All wall mounted combination audio/visual units installed in gymnasiums, corridors, kitchens, preparation and serving area, vocational shops, athletic/drill team training rooms, student restrooms/toilets, cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1220E Series. Provide enviro kit for locations where dampness, water or dust is present.
3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is

louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.

D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.

E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
2. If required to be wall mounted in student toilets, gymnasiums, corridors, student locker / dressing rooms, kitchens, vocational shops, athletic / drill team training rooms, cafeterias, commons areas, provide wire guard protective cover. Provide enviro kit for locations where dampness, water or dust is present.
3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.

F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.

G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.

H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station’s status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present, and in Natatoriums. Verify cover does not interfere with the operation or key reset function.

I. Intelligent Photoelectric Smoke Detectors:
   1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
   2. The detectors shall provide address-setting means electronically and automatically at the control panel and programmed for alarm verification.
   3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
   4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
   5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Duct photoelectric smoke detectors:
   1. Detectors shall be analog addressable type.
   2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
   3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
   4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
   5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
   6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
   7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
   8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
   9. The detectors shall provide address setting means electronically and automatically from the control panel and programmed for alarm verification.

K. Intelligent Thermal Detectors:
   1. The detectors shall use dual electronic thermostats to measure temperature

levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.

2. The detectors shall provide address-setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.
5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.

L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector's alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
3. Electro-chemical CO detection.
4. Integral 85db local alarm with local hush/test switch for silence or test.
5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.

M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.

N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.

O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
2. The monitor module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.

P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which

shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.

Q. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.

R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

S. Silent Knight SK-IP-2UD IP communicator command interface gateway for remote monitoring and control:
1. Intelligent gateway interface for HISD's remote Honeywell VisorAlarm Plus fire monitoring workstation. Interface gateway shall facilitate complete monitoring and control of a networked fire alarm panel software and programming and network diagnostics.

2.5 VESDA – VERY EARLY WARNING ASPIRATING SMOKE DETECTION SYSTEM

A. Approved Manufacturers:
1. System Sensor (FASAST) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
2. Xtralis (VESDA) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.

B. The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port. VESDA detection system shall be networked with the specified Notifier Fire Alarm Control Panel.

C. Design Requirements
1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
2. It shall be tested and approved to cover up to 2,000m^2 (20,000 sq.ft).
3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
4. It shall provide absolute smoke detection.
5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft.).
6. The detector shall be specifically designed for industrial applications.
7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.

8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
9. It shall have four pipe inlets for sample air.
10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.
11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:
    a. Dilute the sampled air for prolonged detector life.
    b. Combine sample air from all pipe inlets.
    c. Divide sampled air into filtered clean air and unfiltered air before mixing them together.
    d. Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
    e. Use a mesh/screen for the unfiltered air for protection against lint type of particles.
    f. Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
    g. Maintain consistent detector sensitivity over time.
    h. Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.
13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.
15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.
23. It shall be self-monitoring for filter contamination.
24. It shall be configured via local USB port with Ethernet port for remote monitoring.
25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
26. It shall have at least one general purpose input (GPI).
27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
28. Optional equipment may include a dedicated Xtralis VSM graphics package.

29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
30. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events.

D. Programming Requirements

Using either USB or Ethernet port the detector shall allow programming of:

1. IP address and related fields to support Ethernet based networking
2. Four smoke threshold alarm levels
3. Time delays
4. Configurable relay outputs for remote indication of detector conditions
5. Holidays and day/night changeover times
6. Major and minor airflow fault limits
7. Aspirator speed
8. General purpose input function
9. Alarm and fault latching

E. Sampling Pipe

1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05” and internal diameter (ID) of 21mm or ¾” should be used.
2. The pipe material should be suitable for the environment in which it is installed. VESDA pipe material shall be UL 1887 Plenum rated CPVC).
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer’s recommendation or that of local codes and standards.
5. All pipes shall be supported at not less than 1.5m (5ft) centres, or that of the local codes or standards.
6. The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on ASPIRE2 calculations.

F. Sampling Holes

1. Sampling holes shall not be separated by more than allowed for conventional point detectors as required by 30 feet as local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30ft.
2. Each sampling point port shall be identified in accordance with Codes or Standards.
3. Provide per manufacturer’s recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.
4. Sample port size shall be as specified by ASPIRE2 calculations.

G. Detection Alarm Levels:

The laser based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:

Alarm Level 1 (Alert)

Activate a visual and audible alarm in the fire risk area.

Alarm Level 2 (Action)

Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.

Alarm Level 3 (Fire 1)

Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Monitoring Service and activate all warning systems.

Alarm Level 4 (Fire 2)

Activate a suppression system and/or other suitable countermeasures.

The alarm level functions as listed are possible scenarios. Program as directed by Owner to the best utilization of these facilities for each application and the requirements of local A.H.J.

H. Initial Detection Alarm Settings

1. Alarm Level 1 (Alert) 0.2% obs/m (0.064% obs/ft.)
2. Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft.)
3. Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft.)
4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft.)

I. Initial (factory default) Alarm Delay Thresholds

Initial (factory default) settings for the alarm delay threshold shall be:

1. Alarm Level 1 (Alert) 10 seconds
2. Alarm Level 2 (Action) 10 seconds
3. Alarm Level 3 (Fire 1) 10 seconds
4. Alarm Level 4 (Fire 2) 10 seconds

J. Fault Alarms: The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays shall also be connected to the appropriate control system. Provide as required by local Codes, Standards or Regulations.

K. Power Supply and Batteries: The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.

1. UL 1481 Listed -provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
2. Provide 120-volt 20-amp circuit from the life safety branch panel to each power supply.

2.6 AUXILIARY EQUIPMENT MONITORING

A. The fire alarm system shall monitor the status of the following equipment when provided as part of this project. A failed status shall activate the trouble alarm.

1. Emergency generator: Run Status
2. Emergency generator: Trouble Signal
3. Fire Pump: Run Status
4. Fire Pump: Trouble Signal

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with

emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.

B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
2. Permit the automatic roll down fire doors/shutters to close automatically.
3. Permit the security grilles with emergency egress to open automatically.
4. Unlock the electrically controlled access doors in all interior spaces.

C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.

D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an alphanumeric display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time-date clock
2. System reset
3. System silence
4. System acknowledge
5. Display/step switch
6. Integral trouble buzzer
7. LCD contrast adjust
8. Fire Drill Operation
9. Owner’s list of all additional remote annunciator control buttons.

B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
2. Individual red system alarm LED
3. Individual yellow supervisory service LED
4. Individual yellow trouble LED
5. Green “POWER ON” LED
6. Alarm acknowledge key
7. Trouble acknowledge key
8. Alarm silence key
9. System reset key
10. LED test

2.9 REMOTE PAGING UNIT

A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.

B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.

C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.

D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.

E. Visual displays, GUIs, or other indicators for main fire alarm panel and all remote annunciators shall be at maximum 66 inches AFF.

F. All remote booster and associated equipment panels shall be mounted with top of enclosure maximum 66 inches AFF.

G. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.

H. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.

I. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.

J. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.

K. Contractor shall submit on completion of system verification, a point-by-point check list

indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.

L. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area, as required by the local AHJ, and additional annunciators where indicated on the drawings as directed by Architect / Owner.

M. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.

N. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.

O. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.

P. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.

Q. Power for magnetic door holders shall be provided from the nearest receptacle circuit wired through fire alarm relay.

R. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.

S. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: “120-Volt Circuit ELA-3”)

T. Provide smoke detectors in the following locations:
1. All paths of egress and adjoining spaces within the same HVAC envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
3. At each computer lab/room.
4. At each library, library office and library ancillary areas.
5. At each storage room, stock room, or warehouse space.
6. At each pre-K and kindergarten classrooms.
7. At nurse’s area/clinic and patient care/cot areas.
8. At each men’s and women’s restroom/toilet
9. At each administrative work room or copy room.
10. At each student toilet / restroom. Provide STI protective cover. Do not locate over plumbing fixtures or near partitions.
11. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.

U. Provide heat/thermal detectors in the following locations:
1. At each electrical room, telecommunications/data room, elevator machine room and mechanical room subject to un-treated or un-filtered outside air.
2. At each janitor's/custodial closets and laundry rooms.
3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
4. At each employee break room/lounge.
5. At each vocational shop.
6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.

V. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.

W. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.

X. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.

Y. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums to avoid exposed conduits.
2. High ceiling areas 25 feet and higher where maintenance of spot type detectors will be difficult.
3. Skylights to avoid exposed conduits.
4. Coolers/Freezers 200 square feet and larger.

Z. Provide manual pull stations at each exterior exit and at each exit from all floors. Provide one manual pull station at the central reception area as directed by Architect/Owner.

AA Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
2. Courtyards and outdoor assembly areas adjacent to the building.
3. Mechanical yards adjacent to the building.
4. Covered playgrounds or covered assembly areas adjacent to the building.
5. Additional locations where indicated on drawings.
6. Outdoor paved play areas.

BB. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

3.2 CABLE AND BOXES INSTALLATION

A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum 18 AWG wire size for data communications, minimum 14 AWG wire size for alarm circuits. Provide minimum 24 inch service loop for every device.

B. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.

C. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.

D. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.

E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.

F. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.

G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.

H. 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%.

I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings, and shall enter or exit the panel from the top only.

J. 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 to view and or subject to damage.

K. 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.

L. All junction boxes containing fire alarm wiring are to be painted red and labeled.

M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable in D-ring hangers, secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.

N. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.

O. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

P. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or 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 and approved by the local authority having jurisdiction.

Q. No other wiring shall be bundled with or run in the same conduit as fire alarm wiring.

3.3 FINISHES

A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

A. General:
1. All fire alarm circuits shall be electrically supervised.
2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.

B. Fire alarm operating sequences shall be as follows:
1. Activation of any automatic detector, manual station, or sprinkler flow switch shall cause the location of alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
   a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
   b. The alphanumeric display shall indicate all applicable information associated with the alarm/trouble condition including: device location based on actual room graphic name and number (not architectural plan names and numbers), device type, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises. Provide abbreviations when required to fit the alarm panel's display format (verify exact requirements with Owner). Below are some examples which first indicate the physical location of the device hardware – then the TYPE of device at the end of the descriptor label:
      1) "Corr 1100 at Rm 1102 - SMOKE" (at Room number shall be the nearest room door to the device).
      2) "Corr 1200 at Rm 1203 - PULL STATION" (at Room number shall be the nearest room door to the device).
      3) "Mech Rm 1352 AHU-11 - DUCT SMOKE"
      4) "Mech Rm 1467 - WATERFLOW SWITCH"
      5) "Mech Rm 1589 - TAMPER SWITCH"
      6) "Kitchen 1623 - HOOD FIRE SUPPRESSION SYSTEM"
      7) "MDF 1733 - DAS RADIO POWER SUPPLY"
      8) "Mech 1855 for Atrium 1863 - VESDA SMOKE"
   c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
   d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and

received.

e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.

f. De-activate local sound reinforcement systems that are not UL listed nor integrated with the fire alarm system control panel for providing fire alarm or mass notification instructions. Building wide public address systems shall remain active only for manual mass notification. Public address system auxiliary audio inputs used for background music or other remote non-emergency audio sources shall be silenced to only allow priority level manual mass notification using the public address system.

g. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.

h. De-activate all HVAC systems.

i. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.

j. Close all related smoke dampers.

k. Close all related smoke/fire dampers.

l. Release all magnetic door hold open devices.

m. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.

n. Release Counter Shutters and hold-open devices on all fire and smoke doors.

o. Open all security grilles with emergency egress.

p. Activate to close all related fire and smoke doors and shutters.

q. Activate signaling connection to the elevator as required by the local authority having jurisdiction.

r. Signal the building automation system and security system, and Owner's security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged, and appropriate action has been taken.

s. Activate automatic recall operation of elevators as required by local authority having jurisdiction.

2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.

3. Activation of a control valve supervisory switch shall initiate the following events:

a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.

b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.

c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence

the audible signal.

4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
6. Upon silencing the alarm, all visible alarm devices shall remain active until system reset and all local sound reinforcement systems de-activated by the fire alarm system shall resume normal operation.
7. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances and de-activate local sound reinforcement system without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.

D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification and information tags. The tags shall include the following information:
1. Name of manufacturer.
2. Manufacturer's equipment description.
3. Serial number and model number.
4. Voltage and current rating.
5. Power circuit source identification with panel name and circuit number.
6. Additional labeling inside panels: Provide stick-on label with white background indicating installation date (MM/DD/YY) on each battery.

B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Provide additional address label on exterior of duct detector housings in addition to label on the duct detector component inside. Verify exact requirements with Owner.

C. All alarm notification devices and end of line resistors shall be labeled with their alarm circuit number and panel name.

3.6 SPARE PARTS AND TOOLS

A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.

B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
   1. Spare shut down modules
   2. Spare detectors of each type in the system
   3. Spare alarm indicating devices of each type in the system
   4. Spare manual pull stations
   5. Spare protective covers of each type in the system.
   6. Spare relays/controls required for connection to smoke and fire/smoke dampers
   7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.

C. Furnish one handheld diagnostic and programming tool, unused, in original manufacturer sealed shipping box to Owner, for Owner's use only.

D. Provide two copies of the final software programmed into the fire alarm system.

E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.

B. Coordinate motor operator voltage with supplier.

C. Open all dampers prior to starting air handling equipment.

D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS FOR AHJ SITE PERMITTING INSPECTION AND OWNER USE

A. It is the intent of these specifications that the fire alarm system shall pass AHJ inspection on the first try. The fire alarm system shall be fully functional, commissioned, and mapped both on fire alarm graphic maps and fire alarm annunciator device descriptions to fully and correctly described the device type and detailed location. Provide color coded floor plans detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers. Fire alarm maps shall include all relevant building information and fire alarm device information as required for the local AHJ permitting site walk-through inspection.

B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator. Indicate location of all end-of-line resistors.

C. Provide two color coded floor plans for Owner's use that shall be solvent welded in acrylic plastic.
   1. Mount in an extruded aluminum frame next to the main fire alarm control panel and annunciator in main office. Minimum size 30x42 inches. Coordinate exact location with Architect / Owner.
   2. Provide a minimum 11 x 17 inch graphic print of building showing all rooms by graphic room numbers. Print shall show all detectors, major equipment and active detection devices. Print shall be framed in an extruded aluminum frame (24"x36") with clear plastic cover. Graphic shall be prepared in AutoCad version 2014 or newer. Data file (xxx.dwg) of graphic shall be provided as a part of the project.

D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 OPERATING INSTRUCTIONS

A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.

B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
   1. Alarm Signal
      a. How to open panel door
      b. What to read and follow the instruction on display
      c. How to acknowledge alarm
      d. How to silence the signals
      e. How and when to reset the system
      f. How to return system to normal operation
   2. Trouble / Supervisory
      a. How to open panel door.
      b. What to read and follow the instruction on display
      c. How to acknowledge trouble condition
      d. Appropriate personnel to respond

C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

A. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.

B. Coordinate door hold devices with door and door hardware.

C. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.

D. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.

E. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

F. Provide one dedicated alarm circuit booster panel and audio amplifier for (future) portable (temporary) building(s) at designated portable building location, at exit door to portable building location.

G. Provide programming of HISD's existing remote Notifier ONYXWorks or Honeywell VisorAlarm workstation. Provide programming of the command interface gateway for remote monitoring and control of the fire alarm panel(s). Provide programming and electronic floor plans of the building for the Graphic User Interface (GUI) at the existing workstation. Provide network connectivity, LAN data drop(s), and all required associated hardware can cabling for remote monitoring and control of the fire alarm panel.

H. Provide programming of HISD's existing remote Notifier ONYXWorks workstation. Provide programming of the ONYXWorks command interface gateway for remote monitoring and control of the fire alarm panel(s). Provide programming and electronic floor plans of the building for the Graphic User Interface (GUI) at the existing workstation. Provide network connectivity, LAN data drop(s), and all required associated hardware can cabling for remote monitoring and control of the fire alarm panel.

3.12 COMMISSIONING THE SYSTEM

A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.

B. A state licensed NICET II minimum and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72 Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.

D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner two weeks prior to testing for the local Fire Marshall to allow time to make corrections, prior to testing for the AHJ.

E. After the Owner has accepted the fire alarm system, the installing contractor's fire alarm

superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel. This test shall not be used to de-bug or correct deficiencies of the system.

F. The testing and Owner's acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:

1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
4. Indicators shall be tested to ensure proper function and operation.
5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
8. Manual initiating devices:
    a. Each manual fire alarm station shall be functionally tested for alarm operation.
    b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
9. Automatic initiating devices:
    a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
    b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
    c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
10. Alarm signaling devices:
    a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
    b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
11. Elevators: Each elevator shall be tested and automatic recall function verified.
12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing

information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.

G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.13 SUBSTANTIAL COMPLETION

A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.

B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.

C. Acceptance by County or Local Fire Marshall.

3.14 TRAINING

A. Provide training course to all fire personnel assigned by Owner’s Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.

B. Provide a video of the training program to the Owner’s Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.

C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.

D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION

SECTION 28 5500
RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC) AND TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

H

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.

1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.

B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.

C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner's business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.

D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds, the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.

E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.

F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

1.2 SURVEY CRITERIA

A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.

B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

1.3 REGULATIONS

A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.

1. NFPA 1 – Fire Code
2. NFPA 70 – National Electrical Code
3. IFC 510- Emergency Responder Radio Coverage
4. NFPA 101, Life Safety Code, and all local amendments and requirements.
5. NFPA 72 National Fire Alarm and Signaling Code
6. FCC 47 CFR Telecommunications
7. FCC 47 CFR 90.219 Use of Signal Boosters
8. IFC - International Fire Code
9. Local or State Fire Codes
10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.
11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
14. IBC - International Building Code
15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner’s specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

1.4 DEFINITIONS

A. Definitions:
1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions related to preparedness, response, and recovery from an active shooter/hostile event response.
3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.
13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

PART 3 – EXECUTION

3.1 EXECUTION

A. Testing Procedures and Parameters
1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.

2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
   a. Fire command centers
   b. Fire pump rooms
   c. Exit stairs
   d. Exit passageways
   e. Elevator lobbies
   f. Areas of rescue or refuge
   g. Areas with or spaces adjacent to standpipe cabinets
   h. Areas with or spaces adjacent to sprinkler sectional valve locations
   i. Areas with or spaces adjacent to bleeding control kits.
   j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
   k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
   l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
   m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
   n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
   o. Other areas deemed critical by the AHJ.
3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:
   a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.
   b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.
4. If there is an existing ERRCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective

measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.

5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
9. Buildings with existing ERRCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
    a. Verify the existing ERRCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
    b. If there is an existing remote ERRCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
    c. The gain values of all existing ERRCES amplifiers shall be measured and documented for comparison for future annual testing of the ERRCES.
    d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
    e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

3.2 SURVEY REPORT SUBMITTALS

A. Submit summary findings and detailed test report data within 14-days of notice to proceed.

. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.

C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.

D. Report data submittals shall include but are not be limited the following:

1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall in include but may not be limited to the following information typically provided by the AHJ(s):
   a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
   b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
   c. Maximum propagation delay in microseconds.
   d. List of specifically approved ERRCES components.
   e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION

SECTION 31 1000
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:
   1. Clearing and grubbing.
   2. Stripping and stockpiling topsoil.
   3. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:
   1. Division 32 Section "Chain Link Fences and Gates" for temporary construction fencing.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 PROJECT 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 traffic ways if required by authorities having jurisdiction.
   3. Do not proceed with work on adjoining property until directed by Engineer.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 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 sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.02 TREE PROTECTION

A. Reference 015639 “Tree and Plant Protection”.

3.03 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. 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 Engineer and Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, 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. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
   4. Use only hand methods for grubbing within tree protection zone.

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 (200 mm) and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
   2. Do not stockpile topsoil within tree protection zones.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Select subparagraph above or below.
   5. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.06 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as 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 length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.07 DISPOSAL

A. Disposal: 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.

1. 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.

END OF SECTION

SECTION 31 2000
EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:
   1. Subgrade course for pavements.
   2. Base material for asphalt paving.

B. All earthwork to be performed and materials used shall be in accordance with the Geotechnical Engineering Report. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the above-referenced report, the City Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Material: Course placed between the subgrade asphaltic concrete paving.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Fill: Soil materials used to raise existing grades.

F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base material.

1.04 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each borrow soil material proposed for fill and backfill.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: On-site soils are suitable for use as fill within the pavement areas, provided they are free from organics and debris. Select fill must be used for grade adjustments in the helipad area.

C. Unsatisfactory Soils: Materials, which do not comply with the requirements for acceptable material or which, cannot be compacted to the specified or indicated density.

D. Subgrade: Stabilize the subgrade to materials as specified by Texas Department of Transportation. The subgrade material should be compacted to at least 98 percent of the modified Proctor maximum dry density (AASHTO T-180).

E. Base Material: The limerock base course should have a minimum Limerock Bearing Ratio (LBR) of 100 and should be compacted to 98 percent of the modified Proctor maximum dry density (AASHTO T-180).

F. Select Fill: USCS Classification CL and/or SC, with a Plasticity Index between 10 and 20.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.04 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.05 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.06 SUBGRADE INSPECTION

A. Notify Testing Agency when excavations have reached required subgrade.
B. If Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.07 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.08 BACKFILL

A. Place all backfill in strict accordance with Geotechnical Report for this project.
B. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
C. Place backfill on subgrades free of mud, frost, snow, or ice.

3.09 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. All compaction in strict accordance with Geotechnical recommendations.
B. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment.
C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under pavements, scarify and recompact existing subgrade and each layer of backfill or fill soil material at 95 percent. Refer to Geotechnical Report for thickness.
   2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area, as indicated in Geotechnical Report, but in no case fewer than 3 tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 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

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

F. Manufacturer's Application Instructions: Indicate caution requirements and materials list of proposed items to be provided under this section.

G. Record and document moisture content of soil before application, date and rate of application, areas of application, and diary of toxicity meter readings and corresponding soil coverage.

H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum 5 years years of documented experience.

I. Maintenance Data: Indicate re-treatment schedule .

J. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of 5 years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Texas.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   2. Inspect annually and report in writing to Owner. Provide inspection service for 5 years from Date of Substantial Completion.
   3. Make inspections, retreatment, and repairs at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Basis of Design:
   1. Dominion 2L Insecticide.

2. Substitutions: See Section 01 6000 - Product Requirements.

D. Mixes: Mix toxicant to manufacturer's instructions.

E. If combinations of toxicants are approved by governmental agencies having jurisdiction, provide toxicants having such approval and in the maximum strength so approved, at no additional cost to the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
1. Under Slabs-on-Grade.
2. In Crawl Spaces.
3. At Interior Side of Foundation Surface.
4. Utility Entrances
5. Immediately below expansion joints, control joints, and all areas where slab will be penetrated by construction features.
6. Where exterior facings or veneers extend below grade level along the exterior side of all foundation walls.
7. Where unit masonry foundation construction is used.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier or void forms.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 31 3213
SOIL MIXING STABILIZATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

B. This Section includes soil mixing stabilization and specialties outside the building, including the following:
   1. Excavation, treatment, and backfilling of subgrade for lime stabilization.

C. All soil mixing stabilization to be performed and materials used shall be in accordance with the Geotechnical Engineering Report. In the event of a discrepancy between the above-referenced report and any portion of this specification section, the above-referenced report will govern. The Contractor shall contact the Engineer in the event of a discrepancy.

1.02 REFERENCE STANDARDS

A. American Society for Testing Materials (ASTM) latest edition
   1. C150 Portland Cement
   2. C618 Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
   3. C 977 Quicklime and Hydrated Lime for Soil Stabilization
   4. D 1633 Compressive Strength of Molded Soil-Cement Cylinders

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   1. M 216 Lime for Soil Stabilization

C. National Lime Association (NLA)
   1. Bulletin 326 Lime Stabilization Construction Manual

D. Texas Department of Transportation Standards
   1. TXDOT Item 260 Lime Treatment (Road Mixed)
   2. TXDOT Item 265 Fly Ash or Lime – Fly Ash Treatment (Road Mixed)

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not install mixed materials in wind in excess of 10 mph or when temperature is below 40 degrees Fahrenheit.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with state and local standards in conjunction with requirements specified herein.

1.05 SUBMITTALS

A. Submit 30-pound sample of each material to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of material that is to be used to the independent testing laboratory for review.

B. Submit name of each materials supplier and specific type and source of each material. Change in source requires approval of Owner.

C. Submit mix design and materials mix ratio that will achieve specified requirements of state and local agencies for soil stabilization.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Hydrated Lime: TXDOT Item 260

2.02 EQUIPMENT

A. Perform operations using suitable, well maintained equipment capable of excavating subsoil, mixing and placing materials, wetting, consolidating, and compacting of material.

PART 3 – EXECUTION

3.01 PREPARATION

A. Obtain approval from the independent testing laboratory of mix design before proceeding with placement.

B. Start stabilization only when weather and soil conditions are favorable for successful application of proposed material.

C. Proofroll subgrade to identify areas in need of stabilization in accordance with Section 312000.

3.02 EXCAVATION

A. Excavate subsoil to depth sufficient to accommodate soil stabilization.

B. Remove lumped subsoil, boulders, and rock that interfere with achieving uniform subsoil conditions.

C. Notify Construction Manager of unexpected subsurface conditions. Discontinue affected work in area until notified to resume work.

D. Correct areas over-excavated in accordance with Section 31 20 00.

E. Remove excess excavated material from site.

3.03 SOIL TREATMENT AND BACKFILLING

A. Lime Stabilized Subgrade: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade with hydrated lime in accordance with state highway department specifications (TXDOT Item 260).

1. A minimum of 48 hours of tempering time shall be provided before final mixing.
2. Subgrade soils shall be treated with lime at a rate of 6 to 8 percent lime, by dry weight.

B. Subsoil shall be in accordance with Section 31 20 00.

C. Maintain optimum moisture of mixed materials to attain required stabilization and compaction.

D. Finish subgrade surface in accordance with Section 31 20 00.

E. Remove surplus mix materials from site at no additional cost to the Owner.

3.04 CURING

A. Immediately following compaction of mix, seal top surface with curing seal.

B. Do not permit traffic for 72 hours after sealing top surface.

3.05 FIELD QUALITY CONTROL

A. Compression test and analysis of hardened fill material will be performed in accordance with Section 02300.

B. If tests indicate work does not meet specified requirements, remove work, replace and retest, at no cost to owner.

END OF SECTION

SECTION 31 5000
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
3. Section 312319 "Dewatering" for dewatering excavations.

1.03 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review coordination with waterproofing.
8. Review abandonment or removal of excavation support and protection system.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
3. Indicate type and location of waterproofing.
4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

C. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.06 FIELD 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 Owner no fewer than two 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 a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

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. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
   1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
   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. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.02 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. 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] [Roll-formed corner shape with continuous interlock].

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
H. Tiebacks: Steel bars, ASTM A 722/A 722M.
I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 2 - EXECUTION

3.01 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 construction and finishing of other work is not impeded.

3.02 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.

3.03 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
B. 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. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.04 TIEBACKS

A. Drill, install, grout, and tension tiebacks.
B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
   1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.05 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.

3.06 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks as required during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain 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.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.07 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying 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

SECTION 31 6329
DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Machine drilled shaft and belled base.

B. Concrete and reinforcement.

C. Shaft liner, if required.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Requirements for concrete reinforcement.

B. Section 03 3000 - Cast-in-Place Concrete: Requirements for concrete.

C. Section 31 0916.21 - Pile Load Tests: Requirements for pile load tests.

1.03 REFERENCE STANDARDS

A. ACI SPEC-336.1 - Specification for the Construction of Drilled Piers 2001.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A252/A252M - Standard Specification for Welded and Seamless Steel Pipe Piles 2019.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

E. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Installer's Qualification Statement.

C. Project Record Documents: Record actual locations of piers, pier diameter, and pier length. Accurately record the following:

1. Sizes, lengths, and locations of piers.

2. Sequence of placement.

3. Final base and top elevations.

4. Deviation from indicated locations.

5. Placement and configuration of reinforcement deviations.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Casing: Temporary casings of steel complying with ASTM A283/A283M, Grade C; ASTM A36/A36M; or ASTM A929/A929M; of sufficient strength to withstand handling and drilling stresses, concrete pressures, and surrounding earth and water pressures.

1. The contractor shall assume for Base Bid that a minimum of 35% of the piers on the project will require steel casing above the bell of the pier to prevent water seepage.

B. Shaft Liner: ASTM A252/A252M, Grade 1; single length steel pipe, with plain ends, of diameter and wall thickness indicated.

C. Concrete Materials and Mix: Specified in Section 03 3000; using Type II cement, maximum 3/4 inch aggregate size, 3,000 psi 28 day strength, 3 inch slump.

D. Equipment: Appropriate for dewatering excavated shaft.

PART 3 EXECUTION

3.01 PREPARATION

A. Use placement method which will not cause damage to nearby structures.

B. Notify adjacent and affected land owners and building occupants with 90 days notice before proceeding with the work.

C. Protect structures near the work from damage.

D. Prepare to place piers from existing site elevations.

E. Grade perimeter of pier and shaft area to prevent surface water from draining into soil borings. Provide temporary means and methods, as required, to maintain surface diversion until no longer needed, or as directed by the Architect.

3.02 INSTALLATION

A. Construct piers in accordance with ACI SPEC-336.1.

B. Drill vertical pier shafts and belled bases to diameters and depths indicated.

C. Place steel casings immediately after drilling. Set firmly in place. If casing is to be temporary, install shaft liner with sufficient strength to withstand concrete pressures.

1. Withdrawal of temporary casings is at option of Contractor.

D. Clean shaft and bottom of loose material. Provide temporary means and methods, as required, to remove all water from soil borings as needed, or until directed by the Geotechnical Engineer.

E. Allow inspection of shaft and liner prior to placement of reinforcement and concrete.

F. Place reinforcing steel in accordance with Section 03 2000.

G. Place concrete in single pour, in accordance with Section 03 3000 with equipment designed for vertical placement of concrete.

H. Coordinate casing withdrawal with concrete placement so that concrete pressure head exceeds anticipated outside soil and water pressure above bottom of casing at all times during withdrawal.

I. Extend reinforcement for connection of caps, grade beams as indicated on drawings.

J. Set tops of piers to elevations indicated.

3.03 TOLERANCES

A. Install piers with maximum variation from location, plumbness, bottom area, diameter, and anchorage locations as specified in ACI SPEC-336.1.

B. Maximum Variation From Vertical: 1 in 48.

C. Maximum Variation From Design Top Elevation: Plus 3 inches, minus 1 inch.

D. Maximum Out-of-Position: 2 inches.

3.04 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 4000 - Quality Requirements.

B. Perform load tests to requirements of Section 31 0916.21.

C. Test Piers: Same diameter and type as specified for other piers, placed in same manner.

D. Accepted test piers may not be used in the Work.

3.05 UNACCEPTABLE PIERS

A. Unacceptable Piers: Piers that fail, are placed out of position, are below elevations, or are damaged.

B. Provide additional piers or replace piers failing to comply with specified requirements.

END OF SECTION 31 6329

SECTION 32 1313
CONCRETE PAVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 – General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes exterior cement concrete pavement for driveways, parking lots, curbs and gutters, and walkways.

B. All concrete paving to be performed and materials to be used shall be in accordance with the Geotechnical Engineering Report and the applicable requirements in the American Concrete Institute's Manual of Concrete Practice. In the event of a discrepancy between the above-referenced report and any portion of this specification section, the above-referenced report will govern. The Contractor shall contact the Engineer in the event of a discrepancy.

1.03 SUBMITTALS

A. Mix Design: Submit one (1) copy of the Mix design prepared by the batch plant servicing the Project.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1.05 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 – PRODUCTS

2.01 FORMS

A. Form Materials: construction grade wood or metal, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

B. 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.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

B. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Tie Bars: ASTM A 615/A 615M, Grade 60.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Portland Cement: ASTM C 150, Type II

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size 1 1/2-inch (38 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. White-Pigmented Curing Compound: ASTM C 1315

2.05 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

2.06 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.

2.07 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 10 inches wide by 72 inches long. Provide chamfered corners and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 18-inch (254-mm) minimum length.

2.08 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
B. Proportion mixtures to provide normal-weight concrete with the following properties:
   2. Compressive Strength (28 Days): 4,000 psi
   3. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50
   4. Slump Limit: 4 inches
C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: do not exceed 2 percent
D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing 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.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a 20-ton pneumatic roller or similar equipment, such as a fully loaded dump truck.

3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."
   Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
   1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   2. Provide tie bars at sides of pavement strips where indicated.
   3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. 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.
C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Extend joint fillers full width and depth of joint.
   2. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
   3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
2. Doweled Contraction 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.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

F. Joint sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.06 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100-cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
2. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 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 (3.4 MPa).

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain 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.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 32 1314
CONCRETE SIDEWALK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 – General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. The work specified in this Section consists of the construction of concrete sidewalk in accordance with these Specifications and in conformity with the lines, grades, dimensions, and notes shown on the plans.

1.03 RELATED WORK

A. Section 024119 – Selective Demolition

B. Division 31 – Earthwork

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete shall be Class A Concrete unless otherwise shown on the plans.

2.02 FORMS

A. Forms for this work shall be made of either wood or metal and shall have a depth equal to the plan dimensions for the depth of concrete being deposited against them. They shall be straight, free from warp or bends, and of sufficient strength when staked, to resist the lateral pressure of the concrete without displacement from lines and grade. Forms shall be cleaned each time they are used and shall be oiled prior to placing the concrete.

2.03 SUBGRADE AND GRADING

A. Excavation shall be made to the required depth, and the foundation material upon which the sidewalk is to be set shall be compacted to a firm, even surface, true to grade and cross-section, and shall be moist at the time that the concrete is placed.

2.04 JOINTS

A. Expansion joints between the sidewalk and the curb, and at all other locations indicated on the plans, shall be 1/4-inch wide, formed with a preformed joint filler. Preformed joint filler shall meet the requirements of AASHTO M153 or AASHTO M213.

B. Contraction joints may be of the open type or may be sawed. Open type contraction joints shall be formed by staking a metal bulkhead in place and depositing the concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, the bulkhead shall be removed. After the sidewalk has been finished over the joint, the slot shall be edged with a tool having a 1/2-inch radius.

If the CONTRACTOR elects to saw the contraction joints, a slot approximately 1/8-inch-wide and not less than 1-1/2 inches deep shall be cut with a concrete saw after the concrete has set, and within the following periods of time:

Contraction joints shall be constructed at not more than twenty (20) foot intervals and shall be in place within twelve (12) hours after finishing.

PART 3 - EXECUTION

3.01 PLACING

B. The concrete shall be placed in the forms to the required depth and shall be vibrated and spaded until mortar entirely covers its surface.

3.02 FINISHING

A. Screeding: The concrete shall be struck-off by means of a wood or metal screed, used perpendicular to the forms, and floated in order to obtain the required grade and remove surplus water and laitance.

B. Surface requirements: The concrete shall be given a broom finish. The surface variations shall not be more than 1/4 inch under a ten-foot straightedge, nor more than 1/8 inch on a five-foot transverse section. The exposed edge of the slab shall be carefully finished with an edging tool having a radius of 1-1/2 inch.

3.03 CURING

A. The concrete shall be continuously cured for a period of at least 72 hours. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently, to permit application of the curing material without marring the surface.

B. Wet burlap, white-pigmented curing compound, waterproof paper or polyethylene sheets may be used for the curing.

END OF SECTION

SECTION 32 1373
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 – General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:
1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated. In the event of a discrepancy between this specification section and the City Design Criteria, the City's Design Criteria shall govern. The Contractor shall notify the Engineer in the event of a discrepancy.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project 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 to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. 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 deg F (4.4 deg C).
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
   1. Available Products:
      a. Crafco Inc.; RoadSaver Silicone.
      b. Dow Corning Corporation; 888.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
   1. Available Products:
      a. Crafco Inc.; RoadSaver Silicone SL.
      b. Dow Corning Corporation; 890-SL.

2.03 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
   1. Available Products:
      a. Crafco Inc.; Superseal 444/777.
      b. Meadows, W. R., Inc.; Poly-Jet 3406.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.
   1. Available Products:
      a. Koch Materials Company; Product No. 9005.
      b. Koch Materials Company; Product No. 9030.
      c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
      d. Approved equals.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
   1. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior 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.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required 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 backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage

or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 32 1723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the bidding and Contract Requirements, and Division 1 – General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. The work covered by this Section shall include the furnishing of all labor, equipment and materials necessary to construct and install all pavement marking, and striping in accordance with the plans and these specifications.

1.3 RELATED WORK

A. Section 321216 – Asphalt Paving
B. Section 321313 – Concrete Paving

1.4 QUALITY ASSURANCE

A. Perform all work in accordance with the requirements of local agencies.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. Chlorinated rubber-alkyd type, as per Fed Spec. No. TT-P-115, Type III, or conforming to the applicable Sections of the Texas Department of Transportation Standard Specifications.
   1. Paint shall be factory mixed, quick drying and non-bleeding type.
   2. Color shall be as per D.O.T. requirements.
   3. Striping, arrows, lane markers and stop bars shall be provided with paint containing reflective additive.

B. Thermoplastic paint shall conform to the applicable Sections of the Texas Department of Transportation Standard Specifications.

C. Traffic paint shall conform to the applicable Sections of the Texas Department of Transportation Standard Specifications.

PART 3 - EXECUTION

3.1 TRAFFIC AND LANE MARKINGS

A. Sweep dust and loose material from the sealed surface.

B. Apply paint striping as indicated on the drawings, with suitable mechanical equipment to produce uniform straight edges.
   1. Apply in not less than (2) two coats as per manufacturer's recommended rates of applications.

C. Protect pavement markings until completely dry in accordance with manufacturer’s recommendations.

END OF SECTION

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work included: Provide chain link fence system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3000 – Administrative Requirements.

B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section;
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
   3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
   4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
   5. Samples: Accompanying the submittal described above, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.04 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.

PART 2 – PRODUCTS

2.01 DIMENSIONAL DATA

A. General:
   1. Pipe sizes indicated are commercial pipe sizes.
   2. Tube sizes indicated are nominal outside dimensions.
   3. H-section sizes indicated are normal flange dimensions.
   4. Roll-formed section sizes indicated are the nominal outside dimensions.

2.02 GALVANIZING

A. On steel framework and appurtenances, provide galvanized finish with not less than the following weight of zinc per sq. ft.
   1. Pipe: 1.8 oz, complying with ASTM A120.
   2. H-sections and square tubing: 2.0 oz, complying with ASTM A123.
   3. Hardware and accessories: Comply with Table 1 of ASTM A153.
   4. Fabric: 2.0 oz, complying with class II of ASTM A121.

2.03 FABRIC

A. Provide number 9 gage or 0.148" wires in 2" or 2-1/4" mesh (match existing), with top knuckled and bottom selvages twisted and barbed.

B. Provide fabric in one piece widths.

2.04 POSTS, RAILS, AND ASSOCIATED ITEMS

A. End, corner, slope, and pull posts: Provide at least the following minimum sizes and weights:
   1. Material and dimensions:
      a. Pipe, 2.875" outside dimension, Lbs. per lin ft: 5.79
      b. Tubing, 2-1/2" square, Lbs per lin ft: 5.70
      c. Roll-formed section, 3-1/2" x 3-1/2", Lbs per lin ft: 5.14

B. Line posts: Provide minimum sizes and weights as follows:
   1. Material and dimensions:
      a. Pipe, 2.375" outside dimension, Lbs. per lin ft: 3.65
      b. H-section, 2.25" x 1.95" x 0.143", Lbs per lin ft: 10.10

C. Gate posts: Provide gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
   1. Material and dimension:
      a. Pipe, 4" outside dimension: Lbs. per lin ft: 9.10
      b. Tubing, 3" square:, Lbs. per lin ft: 9.10
      c. H-section, 4", Lbs. per lin ft: 14.00
         1) Over 13 feet wide, and up to 18 feet wide: Use 6.625" outside diameter pipe weighing 14.0 lbs. per lin ft.
         2) Over 18 feet wide: Use 8.625" outside diameter pipe weighing 24.70 lbs. per lin ft.

D. Top rails:
   1. Use 1.660" outside diameter pipe weighing 1.80 lbs. per lin ft; or
   2. Use 1.625" x 1.25" roll-formed sections weighing 1.35 lbs. per lin ft.
   3. Provide in manufacturer's longest lengths, with expansion type couplings approximately 6" long for each joint.
   4. Provide means for attaching top rail securely to each gate, corner, pull, slope, and end post.

E. Mid-Rails:
   1. Provide mid-rail for fences 8'-0" tall and higher, same as top rail.

F. Post brace assemblies:
   1. Provide at end and gate posts, and at both sides of corner, slope, and pull posts, with the horizontal brace located at mid-height of the fabric.
   2. Use 1.660" outside diameter pipe weighing 1.80 lbs. per lin ft for horizontal brace.
   3. Use 3/8" diameter rod with turnbuckle for diagonal truss.

G. Tension wire: Provide number 7 gage galvanized coiled spring wire at bottom of fabric.

H. Post tops:
   1. Provide steel, wrought iron, or malleable iron, designed as weathertight closure cap.
   2. Provide one cap for each post.
   3. Provide caps with openings to permit through passage of top rail.

I. Stretcher bars:
   1. Provide one-piece lengths equal to full height of fabric, with a minimum cross-section of 3/16"x 3/4".
   2. Provide one stretcher bar for each gate and end post, and two for each corner, slope, and pull post, except where fabric is woven integrally into the post.

J. Stretcher bar bands:
1. Provide steel, wrought iron, or malleable iron, spaced not over 15" on centers, to secure stretcher bars to end, corner, pull, slope, and gate posts.
2. Bands may be used also with special fittings for securing rails to end, corner, pull, slope, and gate posts.

2.05 GATES

A. General:
1. Fabricate gate perimeter frames of tubular members.
2. Provide additional horizontal and vertical members to assure proper operation of the gate, and for attachment of fabric, hardware, and accessories.
3. Space so frame members are not more than 8 feet apart.
4. Fabricate gate frames from:
   a. Materials and dimension:
      1) Pipe 1.90" outside diameter, Lbs. per lin ft: 2.72
      2) Tubing, 2" square, Lbs. per lin ft: 2.60

B. Fabrication:
1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
2. Use same fabric as used in the fence.
3. Install fabric with stretcher bars at vertical edges as a minimum.
4. Attach stretchers to gate frame at not more than 15" on centers.
5. Attach hardware with rivets or by other means which will provide security against removal and breakage.
6. Provide diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.

C. Gate hardware: Provide following for each gate:
1. Hinges:
   a. Pressed or forged steel, or malleable iron, to suit the gate size; non-lift-off type, offset to permit 180 degree opening.
   b. Provide 1-1/2 pr of hinges for each leaf over 6 feet in nominal height.
2. Latches:
   a. Provide forked type or plunger-bar type to permit operation from either side of the gate.
   b. Provide padlock eye as integral part of latch.
3. Keeper: Provide keeper for vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
4. Double gates:
   a. Provide gate stops for double gates consisting of mushroom or flush plate, with anchors.
   b. Set in concrete to engage the center drop rod or plunger bar.
   c. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
5. Security gates:
   a. For each leaf, top hinge shall be Locinox; MAMMOTH-180 Hydraulic Gate Closer & Hinge.
   b. For additional security hardware refer to 08 7100 - Door Hardware.

2.06 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Wire ties:
1. For tying fabric to line posts, use number 9 gage wire ties spaced 12" on centers.
2. For tying fabric to rails and braces, use number 9 gage wire ties spaced 24" on centers.

3. For tying fabric to tension wire, use number ll gage hog rings spaced 24" on centers.
4. Manufacturer's standard wire ties will be acceptable if of equal strength and durability.

B. Concrete: Comply with provisions of Section 03 3000 – Cast-in-Place Concrete for 2500 psi concrete.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 GUARANTEE

A. The contractor shall furnish a written guarantee warranting all materials, devices, and workmanship to be free of defects for a period of one year from the date of completion and acceptance. Any defects in materials, devices, and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense, and at no additional cost to the Owner.

3.03 INSTALLATION

A. General:
1. Install posts at a maximum spacing of 10 feet on centers.
2. Install corner or slope posts where changes in line or grade exceed a 30 degree deflection.

B. Excavating:
1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
2. Post hole dimensions:
   a. Provide 30" deep by 8" diameter foundations for line posts for 5 foot fabric height and less.
   b. Provide 36" deep by 8" diameter foundations for line posts for fabric heights exceeding 5 feet.
   c. Provide 36" deep by 12" diameter foundations for all other posts.
3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.
4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.
5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified above.

C. Setting posts:
1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
2. Center and align posts in holes.
3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.
4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
5. Trowel tops of footings, and slope or dome to direct water away from posts.
6. Extend footings for gate posts to the underside of bottom hinge.
7. Set keeps, stops, sleeves, and other accessories into concrete as required.
8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method approved by the Architect.

9. Grout-in those posts which are set into sleeved holes, concrete constructions, or rock excavations, using non-shrink Portland cement grout or other grouting material approved by the Architect.

D. Concrete strength:
1. Allow concrete to attain at least 75% of its minimum 28-day strength before rails, tension wires, and/or fabric is installed.
2. Do not, in any case, install such items in less than seven days after placement of concrete.
3. Do not stretch and tension fabric and wire, and do not hang gates, until concrete has attained its full design strength.

E. Rails and bracing:
1. Install fence with a top rail and bottom tension wire.
2. Install top rails continuously through post caps or extension arms, bending to radius for curved runs.
3. Provide expansion couplings as recommended by the fencing manufacturer.
4. Provide bracing to the midpoint of the nearest line post or posts at all end, corner, slope, pull, and gate posts.
5. Install tension wires parallel to the line of fabric by weaving through the fabric, and tying to each post with not less than number 6 gage galvanized wire, or by securing the wire to the fabric.

F. Installing fabric:
1. Leave approximately 2" between finish grade and bottom selvage.
2. Excavate high points in the ground to clear the bottom of the fence.
3. Place and compact fill to within 1" of the bottom of the fabric in depressions.
4. Pull fabric taut and tie to posts, rails, and tension wires.
5. Install fabric on outward side facing side of fence, and anchor to framework so that the fabric remains in tension after pulling force is removed.
6. Install stretcher bars by threading through or clamping to fabric on 4" centers, and secure to posts with metal bands spaced 15" on centers.

G. Installing gates:
1. Install gates plumb, level, and secure for full opening without interference.
2. Install ground-set items in concrete for anchorage in accordance with the fence manufacturer's recommendations as approved by the Architect.
3. Lubricate and adjust the hardware for smooth operation.

H. Miscellaneous:
1. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
2. Bend ends of wire to minimize hazards to persons and clothing.
3. Fasteners:
   a. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
   b. Peen the ends of bolts to prevent removal of nuts.
4. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as approved by the Architect.

END OF SECTION

SECTION 33 0500
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.City
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.03 DEFINITIONS

B. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

C. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

D. ABS: Acrylonitrile-butadiene-styrene plastic.

E. CPVC: Chlorinated polyvinyl chloride plastic.

F. PE: Polyethylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

H. Product Data: For the following:
1. Dielectric fittings.
2. Identification devices.

1.05 INFORMATIONAL SUBMITTALS

I. Welding certificates.

1.06 QUALITY ASSURANCE

J. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

K. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
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.

L. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.07 DELIVERY, STORAGE, AND HANDLING

M. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

N. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.08 COORDINATION

O. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

P. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

Q. Coordinate size and location of concrete bases.

PART 2 - PRODUCTS

2.01 PIPING 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 otherwise 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.
2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

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 general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

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. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.
5. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.02 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:
   1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
   2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements.
   3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements.
   3. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements.
   3. Description: MSS SP-107, PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements.
   3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.03 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements.
   3. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
      a. Pressure Rating: 150 psig minimum at 180 deg F.

b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
a. Pressure Rating: 150 psig minimum.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements.
3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
a. Pressure Rating: 150 psig minimum.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements.
3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.
a. Pressure Rating: 300 psig at 225 deg F.
b. End Connections: Threaded.

F. Dielectric Nipples:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements.
3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
a. Pressure Rating: [300 psig (2070 kPa) at 225 deg F (107 deg C)] <Insert pressure and temperature>.
b. End Connections: Threaded or grooved.

2.04 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.05 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
   2. Location: Accessible and visible.
C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.
   1. Material: Fiberboard, Brass.
   2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
   1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
   2. Color: Comply with ASME A13.1, unless otherwise indicated.
K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
   1. Material: 0.032-inch- thick, [polished brass] [or] [aluminum].
   2. Material: 0.0375-inch- thick stainless steel.

3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link, or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.07 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel, or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.01 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
1. NPS 2 and Smaller: Dielectric.
2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8: Dielectric nipples.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.03 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements 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 the Coordination Drawings.

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 to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas [2 inches above finished floor level.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.04 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. 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 (0.20 percent maximum lead content) complying with ASTM B 32.

I. 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.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, 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.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End PE Pipe and Fittings: Use butt fusion.
   2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Install dielectric fittings at connections of dissimilar metal pipes.

3.06 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.07 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.08 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
   1. Stenciled Markers: According to ASME A13.1.
   2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
   3. Locate pipe markers on exposed piping according to the following:
   4. Near each valve and control device.
   5. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   6. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   7. At manholes and similar access points that permit view of concealed piping.
   8. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
   1. Lettering Size: Minimum 1/4-inch-high for name of unit if viewing distance is less than 24 inches, 1/2-inch-high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
   2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.09 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout.

END OF SECTION

SECTION 33 1110
PVC WATER PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to install polyvinyl chloride (PVC) water pipe and ductile iron fittings for the water line, including excavation, sheeting, shoring, dewatering, pipe laying, jointing, testing, backfilling and any other work that is required or necessary to complete the installation as shown on the Plans and as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 1.

B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 QUALITY ASSURANCE

A. All PVC pipe and fittings shall be from a single Manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 or ASTM F789 and/or ASTM F758 as applicable.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Polyvinyl chloride pipe for water lines, unless otherwise specifically shown on the Plans, or approved in writing, shall be AWWA C900, C905, or C909 Class 150 psi with a dimension ratio of 18 (DR-18), for water lines and shall be extruded, be of rubber gasket type, and be furnished in 20-foot nominal laying lengths. All such pipe shall bear a mark denoting approval by the Underwriters' Laboratories of Chicago, Illinois, so that it will be acceptable to the Texas State Fire Insurance Commission for use in fire protection lines without penalty. All joints shall be of the type which provides a recession in the bell for the employment of a single rubber gasket to be placed before the insertion of the succeeding spigot. Each size of polyvinyl chloride pipe shall have the same outside diameter as the corresponding size of cast iron pipe.

B. Fittings shall be ductile iron, mechanical joint or flanged type and shall be Class 250 in accordance with AWWA Specifications C110-77, C-111-80, and C115-75. Flanges shall be faced and drilled in accordance with ASA Standard B16.1, Class 125 unless otherwise shown on the Plans or in the Special Conditions. All fittings shall be tar coated on the outside surface and shall have an interior cement lining with seal coat per AWWA Specifications C104-80 unless otherwise shown or specified.

C. The Contractor shall obtain installation instructions, including support spacing and solvent welding, from the supplying Manufacturer, shall comply with the instructions, and shall meet the requirements of ASTM D-2855, Standard Recommended Practice for making Solvent Cemented Joints with PVC Pipe and Fittings. The PVC solvent cement shall comply with ASTM D-2564 and shall be furnished by the pipe and fitting Manufacturer for the class and type of pipe supplied to the project.

PART 3 – EXECUTION

3.01 HANDLING AND CUTTING PIPE

A. Pipe and fittings are slightly brittle. Care shall be taken in shipping, handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction.

B. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and

removed at once from the work.

C. All pipe ends shall be square after cutting.

D. While stored, pipe shall be adequately supported from below at not more than three (3) foot intervals to prevent deformation. Pipe shall not be stacked higher than six (6) feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of direct sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

3.02 JOINTING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. PVC pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the Manufacturer.

3.03 INSTALLING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Unless otherwise specified on the Plans, polyvinyl chloride pipe shall be installed to clear all utility lines and shall have three (3) feet minimum cover. For water lines to be constructed under a future roadway, the cover may be increased to allow for future paving grades. The depth of cover, where shown on the Plans, is that distance from the top of the pipe to the approximate proposed grade line.

B. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the Manufacturer shall be explicitly followed.

C. Any pipe or fittings discovered to be defective after laying shall be removed and replaced with a sound piece.

D. The Engineer or the City may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.

E. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying.

F. Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM D2321 and as specified herein. As soon as the excavation is complete to normal grade of the bottom of the trench, embedment material shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Plans. The specified embedment shall be accurately shaped and trimmed to receive the pipe barrel and each pipe section, when in place, shall have a uniform bearing on the subgrade for the full length of the pipe barrel. Pipe shall not be laid unless the subgrade is free of water and in a satisfactory condition. Embedment material shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the embedment material under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Embedment material shall then be placed to 12-inches above the top of the pipe. Next, the varying depths of select material backfill above the embedment material backfill shall be placed according to the Plan Details and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient select material backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the varying depths of select material backfill shall be approved by the pipe Manufacturer's representative prior to use. Adjustments of the pipe to line and grade shall be made by scraping away or filling in with granular material, and not by wedging or blocking up the bell.

G. Perforated PVC Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM F758 and as specified herein. As soon as the excavation for the trench is complete to normal grade of the bottom of the trench, geotextile fabric shall be laid and then the pea gravel bedding shall be carefully placed (so not to damage the geotextile fabric) and graded to provide uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. Before the perforated pipe is laid on the trench, the perforated pipe shall be wrapped around and closed according to the Manufacturer's closure recommendations with the geotextile fabric. The pipe shall be laid accurately to the lines and grades indicated on the Plans. Blocking under the perforated PVC pipe will not be permitted. Pea gravel shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to gently place the pea gravel under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Making sure not to damage the geotextile fabric, pea gravel shall then be carefully placed above the top of the perforated pipe varying from two to three (2-3) feet depending on the Plans. Once the remaining pea gravel has been placed, overlap or close the geotextile fabric according to the Manufacturer's recommendations or six (6) inches minimum overlap. Then one (1) foot of topsoil shall be placed over the pea gravel to the ground level with proper grass sodding on top.

H. Joints shall not be "pulled" or "cramped". Each joint of pipe shall be completed in compliance with Manufacturer's recommendations.

I. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

J. Precautions shall be taken to prevent flotation of the pipe in the trench.

K. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill or embedment material. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, embedment material shall be placed to fill any voids created and the embedment material and backfill shall be recompacted to provide uniform side support for the pipe.

3.04 CONCRETE AND BLOCKING

A. 2,500 psi concrete shall be placed for blocking at each change in direction in the pipeline, as shown in the Standard Details and in such manner as will substantially brace the pipe against undisturbed trench walls. In no event shall this quantity of concrete blocking be less than those shown in the Plans. Concrete blocking, made from Type I cement, shall have been in place four (4) days prior to testing the pipeline as hereinafter specified. Tests may be made in two (2) days after completion of blocking if Type III cement is used.

B. At all points where wet connections are made to existing lines, the existing lines shall be adequately blocked and the tapping connection fittings shall be supported by blocking up to the spring line with 2,500 psi concrete.

3.05 LEAKING TESTING AND STERILIZATION

A. General

1. All leakage testing and sterilization shall be per Utility Owner's requirements. Contractor to coordinate with Utility Owner for procedures, timing, and witnessing of testing and sterilization. This section outlines minimum requirements and guidelines for testing and sterilization.

2. After the pipe has been laid and backfilled and the backfill has been otherwise consolidated, all newly laid pipe, or any valved section thereof, shall be subjected to the

hydrostatic pressure specified below for that particular type of pipe. The duration of the hydrostatic test shall be at least two (2) hours. Unless otherwise specified or noted on the Plans. All meters, fixtures, devices or appliances which are connected to the pipeline system and which might be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped during the testing procedures.

3. Each valved (capped or plugged) section of pipe shall be filled slowly with water and all air shall be expelled. If permanent air vents are not located at all high points, the Contractor shall install, at his own expense, corporation or blow-off cocks at such points so that air can be expelled as filling takes place. After verification that all air has been expelled, the cocks shall be closed and the pipe kept filled until tested. All exposed pipe, fittings, valves, hydrants and joints shall be examined while under test pressure and all visible leaks shall be stopped. Any cracked or defective pipe, fittings, valves or hydrants discovered during testing shall be removed and replaced by the Contractor. Replacement shall be with sound material and the test shall be repeated until satisfactory to the Engineer.

B. Special Requirements: Where any section of pipeline is provided with concrete reaction blocking, the hydrostatic pressure shall not be made until at least five (5) days have elapsed after installation of the blocking. However, if high-early-strength cement is used in the concrete, two (2) days shall have elapsed prior to testing.

C. Leakage Test: A Leakage Test will be conducted on each valved section over the entire Project. The leakage test shall be at 150 psi for at least four (4) hours.

D. Allowable Leakage

1. The allowable hydrostatic leakage rate shall be based on the following formula:

$L = SD\sqrt{P}/133{,}200$

L = testing allowance in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the hydrostatic test in pounds per square inch (gauge)

Table 6A - Hydrostatic testing allowance per 1,000 ft of pipeline* - *gph*†

	Nominal Pipe Diameter – in.																	
Avg Test Pressure	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64
psi																		
450	.48	.64	.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60	9.56	10.19
400	.45	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11	9.01	9.61
350	.42	.56	.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58	8.43	8.99
300	.39	.52	.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02	7.80	8.32
275	.37	.50	.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72	7.47	7.97
250	.36	.47	.71	.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41	7.12	7.60
225	.34	.45	.68	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03	6.76	7.21
200	.32	.43	.64	.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73	6.37	6.80
175	.30	.40	.59	.80	.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36	5.96	6.36
150	.28	.37	.55	.74	.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97	5.52	5.88
125	.25	.34	.50	.67	.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53	5.04	5.37
100	.23	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.80

If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.
†Calculated on the basis of Eq. 1.

a. These formulas are based on a testing allowance of 11.65 gpd/mi/in. (1.079 L/d/km/mm) of nominal diameter at a pressure of 150 psi (1,034 kPa).
b. When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gal/h/in. (1.2 mL/h/mm) of nominal valve size shall be allowed.
c. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.
d. Acceptance of installation. Acceptance shall be determined on the basis of testing allowance. If any test of laid pipe discloses a testing allowance greater than that specified, repairs or replacements shall be accomplished in accordance with the specifications.
e. All visible leaks are to be repaired regardless of the allowance used for testing.

2. If such testing discloses leakage in excess of this specified allowable, the Contractor, at his expense, shall locate and correct all defects in the pipeline until the leakage is within the specified allowance. All known leaks, regardless of this test, shall be repaired.

E. Pressure Test: After satisfactorily completing the leakage test, each valved section over the entire project, shall be tested at 200 psi for a sufficient period (approximately 10 min) to discover all leaking or defective materials and/or workmanship.

F. Disinfecting Water Mains: The Contractor shall disinfect all water mains before the new facilities are placed into service. Disinfection must be performed in accordance with AWWA C651, latest revision and water samples must be submitted to a laboratory approved by the Texas Department of Health. Sample must be collected by the Contractor or his representative in the presence of the City or his representative. The Contractor shall be responsible for delivering the samples to an approved laboratory for testing. Sample results must indicate the facility is free of microbiological contamination before it is placed into service. It shall be the Contractor's responsibility to obtain a current copy of AWWA C651 to determine the correct forms of chlorine for disinfection, the basic disinfection procedure, preventive and corrective measures during construction, methods of chlorination, final flushing procedures, procedures for bacteriological tests, procedures for redisinfection and disinfection procedures when cutting into existing mains. The Contractor, at its expense, will supply the concentrated chlorine disinfecting material, the City's personnel will supervise and direct the overall sterilization procedure. The Contractor, at his own expense, shall provide all other equipment, supplies and necessary labor to perform the sterilization under general supervision by the City.

G. General

1. All valves shall be arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The new pipeline shall then be completely filled with disinfecting solution by feeding the concentrated chlorine and approved water from the existing system uniformly into the new piping in such proportions that every part of the line has a minimum concentration of chlorine as prescribed in AWWA C651.
2. Unless otherwise identified, all quantities called for herein refer to measurements by the testing procedures in the current edition of "Standard Methods of Examination of Water and Wastewater". The chlorine concentration of each step in the sterilization procedure shall be verified by chlorine residual determinations. This disinfecting solution shall be retained in the piping for at least twenty-four (24) hours, and all valves, hydrants, etc., shall be operated to disinfect all their parts. After this retention period, the water shall contain no less than the chlorine residual prescribed in AWWA C651 throughout the treated section of the pipeline.
3. This heavily chlorinated water shall then be carefully flushed from the line until the chlorine concentration is not higher than the residual generally prevailing in the existing distribution system, or approximately 1.0 parts per million. Proper planning and appropriate preparations to handle, dilute and dispose of this strong chlorine solution without causing injury or damage to the public, the water system, the environment must

be approved by the City before flushing of the line may begin, and the flushing shall be witnessed by an authorized representative of the City.

H. Bacteriological Testing
   1. After final flushing of the strong disinfecting solution, water samples from the line shall be tested for bacteriological quality, at the Contractor's expense, and must be found free of coliform organisms before the pipeline may be placed in service. One (1) test sample shall be drawn from the end of the main and additional samples collected at intervals of not more than one-thousand (1,000) feet along the pipeline. A minimum of three (3) samples must be collected.
   2. The Contractor, at his own expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed and retained for future use.
   3. Samples for bacteriological analysis shall be collected only from suitable taps, in sterile bottles. Collection of the test samples shall be made in the presence of City personnel. If the initial disinfection fails to produce acceptable sample tests, the disinfection procedure shall be repeated (without extra compensation) until satisfactory test results have been obtained, before the piping may be placed in service.

END OF SECTION

SECTION 33 1215
VALVES, HYDRANTS, AND APPURTENANCES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to provide all buried valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Plans and as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 1.
B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 REFERENCE STANDARDS

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
B. American Water Works Association (AWWA)
   1. AWWA C500 - Gate Valves, three (3)-inch through 48-inch NPS, for Water and Sewage Systems.
   2. AWWA C502 - Dry-Barrel Fire Hydrants.
   3. AWWA C509 - Resilient-Seated Gate Valves, three (3) inch through 12-inch NPS, for Water and Sewage Systems.
C. American National Standards Institute (ANSI)
   1. ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.
   2. ANSI C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
D. American Society for Testing and Materials (ASTM)
   1. ASTM A48 - Gray Iron Castings.
   2. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings
   3. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   4. ASTM A276 - Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.
   5. ASTM A536 - Ductile Iron Castings.
E. Steel Structures Painting Council (SSPC)
   1. SSPC SP-6 - Commercial Blast Cleaning
F. Where reference is made to one (1) of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the work.
B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.
C. Provide covers for all openings.
   1. All valves three (3) inches and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.
   2. All valves smaller than three (3) inches shall be shipped and stored as above except that heavy card board covers may be furnished instead of wood.
D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of Owner acceptance shall be removed, or the valve shall be removed from the job.
E. Store all equipment in covered storage off the ground.

1.05 COORDINATION

A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation and site utilities.
B. Contractor shall coordinate the location and placement of concrete thrust blocks when required.

1.06 GENERAL

A. All valves shall open counter-clockwise.
B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
C. Valves shall be of the size shown on the Plans or as noted, and as far as possible equipment of the same type shall be identical and from one Manufacturer.
D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.
E. Unless otherwise noted, valves shall have a minimum working pressure of 200 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.
F. Valves shall be of the same nominal diameter as the pipe or fittings they are connected to. Except as otherwise noted, joints shall be mechanical joints, with joint restraint where the adjacent piping is required to be restrained.
G. Valves shall be constructed for buried service.

PART 2 – PRODUCTS

2.01 VALVE BOXES

A. All gate valves shall be provided with extension shafts (where the operating nut is greater than five (5) feet below grade), operating nuts and valve boxes as follows:
   1. Extension shafts shall be steel and the operating nut shall be two (2) inches square. Shafts shall be designed to provide a factor of safety of not less than four (4). Operating nuts shall be pinned to the shafts.
   2. Valve boxes shall be a heavy-pattern cast iron, three (3) piece, telescoping type box with dome base suitable for installation on the buried valves. Inside diameter shall be at least 5¼-inches. Barrel length shall be adapted to the depth of cover, with a lap of at least six (6) inches when in the most extended position. Covers shall be cast iron with integrally-cast direction-to-open arrow and "WATER" shall be cast in the cover when used on a water line or "SEWER" when used on a wastewater force main. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box. The valve box lid shall be furnished with a pentagon-head bolt for locking.
   3. The upper section of each box shall have a bottom flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.
   4. An approved operating key or wrench shall be provided.
   5. All fasteners shall be Type 304 stainless steel.

2.02 RESILIENT SEATED GATE VALVES

A. Valves shall be manufactured in accordance with AWWA C509. Acceptable Gate Valves are:
   1. American Flow Control – Series 2500
   2. Mueller – 2360 Series
   3. Clow
B. Valves shall be provided with a minimum of two (2) O-ring stem seals.
C. Bonnet and gland bolts and nuts shall be either fabricated from a low alloy-steel for corrosion

resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM A153 is not acceptable.

D. Wedges shall be totally encapsulated with rubber.

E. Units shall be, in addition, UL and FM approved.

F. Resilient wedge gate valves shall be furnished and installed in sizes and shall be manufactured in accordance with the latest AWWA C-509 and cast iron shall conform to the latest ASTM A-126 standards. Gate valves furnished under these specifications shall be of the solid wedge, resilient seat type with cast iron/ductile iron body and bronze stem designed for 250 pounds per square inch working pressure. All gate valves shall be tested hydrostatically to 400 pounds per square inch. Gate valves shall meet the latest AWWA standard specifications (C-509).

G. The seat shall be made of Styrene Butadiene rubber and provide a positive water tight seal. The seat shall be permanently bonded or mechanically attached to the wedge with stainless steel screws. If bonded, ASTM P-429 requirements shall be followed. Non-rising stem gate valves shall be equipped with “O” ring type packing gland consisting of at least two (2) “O” rings. The thrust collar shall work in an “O” ring seal lubricant reservoir or against bearings or washers, above and below constructed of Delrin or approved equal material. Gate valve stems, shall be fabricated from solid bronze rod having a tensile strength of not less than 60,000 pounds per square inch, and a minimum yield strength of 30,000 pounds per square inch.

H. Cast iron body shall be of iron with an even grain and shall possess a tensile strength of not less than 32,000 pounds per square inch. All bronze castings, except the stem, shall have a tensile strength of not less than 30,000 pounds per square inch. The entire internal valve body surfaces shall be coated with a factory applied two (2) component epoxy system or approved equal. The seating surface shall be machined or otherwise constructed to provide a smooth, even surface for the resilient seat. All valves shall open left (counter clockwise) and have a two (2) inch square wrench nut unless specified otherwise.

2.03 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be of cast iron epoxy coated, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by A.P. Smith Division of U.S. Pipe, Mueller, Clow, or equal. Nuts and bolts shall be Type 304 stainless steel.

B. Size-on-Size tapping sleeve shall be ductile iron or cast iron.

C. Tapping valves shall conform to the requirements specified above for gate valves except that one (1) end shall be flanged and one (1) mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters. Tapping valves shall be Ford B81-777 or equal.

2.04 CHECK VALVES

A. Controlled Closing Swing Check Valves (lever & weight)

1. Check valves shall be of the controlled closing swing type. The controlled closing swing check valves shall be guaranteed to operate under severe conditions as check valves. The valve shall be designed to open smoothly, provide full pipe line flow, permit minimum head loss and close at a controlled rate of speed for the final predetermined portion of its stroke. All bolts and nuts used in the assembly shall be steel, commercial.
2. The valve body shall be Cast Iron ASTM A126-B/ductile iron ASTM A536. The disc arm and chamber level shall be of heavy steel construction and keyed to the hinge shaft. The hinge shaft shall be of 18-8 stainless steel and of adequate diameter to withstand a complete hydraulic unbalance pressure of 125 psi on the valve disc. A single cushioning device mounted on the external side of the valve shall control the valve closure by way of the interchange of oil to and from an oil reservoir. The use of air or gas pressurized oil

reservoir shall not be permitted. The oil plunger assembly shall be rigidly attached to the valve body by shoulder bolts or dowel pins to prevent fretting.

3. The Manufacturer, if required by the Engineer or the City, shall submit design calculations of principle component stresses to substantiate the integrity of the valve for the working pressure involved.
4. The valve when closed shall be tight seating by way of a resilient replaceable seat against a bronze seat ring in the body.
5. Valves shall be as manufactured by GA Industries or Series 6000 as manufactured by APCO. The City reserves the right to inspect all valves before shipment is made. Any failure of valves to operate satisfactorily during the first year of installation due to faulty workmanship or defective material shall be replaced and made good by the Manufacturer. Under these specifications, any valve stuffing box that leaks for any reason or because of excessive wear or deterioration of packing, shall be reason for classification as defective material.

A. Slanted / Tilted Check Valves

1. Slanted or tilted check valves shall be furnished and installed where shown on the Plans.
2. The body of the valve shall be ductile iron or cast iron with access ports to the disc. The disc shall be cast iron. The seat and disc rings shall be bronze. Pivot pins and bushings shall be bronze or stainless steel. The valve shall include a localized indicator of the position of the valve.
3. The valves shall include a top mounted oil dash pot to prevent slamming of the disc. The dash pot shall control the last 10% of closure of the disc. The speed of closure within this 10% shall be adjustable.
4. Valves shall be APCO Slanting Disc, Valmatic or Golden Anderson Tilted Disc or approved equal.

2.05 FLANGES

A. A. Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Dimensions and drilling of flanges shall be in accordance with the American Standard Association for a working pressure of 125 pounds per square inch. Special drilling shall be provided where necessary.

2.06 FIRE HYDRANTS

A. Fire hydrants shall be dry-barrel type conforming to the requirements of the latest revision of AWWA C502. Hydrants shall be designed such that the hydrant valve closes with line pressure preventing loss of water and consequent flooding in the event of traffic damage.

B. Hydrants shall have six (6)-inch mechanical joint inlet connections, two 2½-inch hose connections and one 41/2-inch pumper connection. Threads for the hose and pumper connections shall be in accordance with National Standard Thread. Hydrants shall be according to Manufacturer's standard pattern. Hydrants shall be equipped with "O" ring packing. Each nozzle cap shall be provided with a Buna-N rubber washer.

C. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism or obstructing the discharge from any outlet. The body of the hydrant shall be equipped with a breakable flange, or breakable cast iron flange bolts, just above the grade line.

D. A bronze or rustproof steel nut and check nut shall be provided to hold the main hydrant valve on its stem.

E. Hydrant valve opening shall have an area at least equal to that area of a 41/2-inch minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2½-inch hose nozzles when opened together with a loss of not more than two (2) psi in the hydrant.

F. Hydrants shall be designed for installation in a trench that will provide minimum cover as noted on Plans and for the flange to be 3 ½-inches above ground surface. Hydrant extensions

shall be as manufactured by the company furnishing the hydrants and of a style appropriate for the hydrants as furnished.

G. Hydrants shall be provided with an automatic and positively operating, non-corrodible drain or drip valve so as to drain the hydrant completely when the main valve is shut. A drain valve operating by springs or gravity is not acceptable.
H. Operating stems whose threads are located in the barrel or waterway shall be of manganese bronze, everdur, or other high-quality non-corrodible metal, and all working parts in the waterway shall be bronze to bronze.
I. Hydrants shall open by turning operating nut to left (counter-clockwise) and shall be marked with a raised arrow and the word “open” to indicate the direction to turn stem to open hydrant.
J. Hydrants shall be furnished with caps, double galvanized steel hose cap chain, galvanized steel pumper hose cap chain, a galvanized steel chain holder and any other hooks and/or appurtenances required for proper use.
K. Hydrant operating nut shall be AWWA Standard pentagonal type measuring 1½-inch point to flat.
L. Hydrants shall be hydrostatically tested as specified in AWWA C502.
M. Hydrants Manufacturer and Type shall be per City requirements
N. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two (2) coats of asphalt varnish specified in AWWA C502. Iron work to be left above ground shall be factory primed and painted per City requirements using a high-grade enamel paint of quality and color to correspond to the present standard of the City.
O. Fire hydrants shall be installed on the same side of the street or roadway as the water main and shall be installed plumb and true.
P. Heel and thrust blocks shall be placed in undisturbed soil as shown in the details of the Plans.
Q. Double blue reflector “HYE – LITES” brand as manufactured by pavement markers ink shall be installed at the centerline of the street or roadway perpendicular to the hydrant.

2.07 CORPORATION STOPS

A. Corporation stops shall be brass, not less than 1-inch in diameter and shall be installed where shown, specified or required.
B. Provide corporation stops as manufactured by the following:
   1. Ford Company

2.08 COMBINATION AIR-VACUUM RELIEF VALVES

A. The air-vacuum release valves shall be installed as shown on the Plans. The valve body shall be of cast iron ASTM A126-B; the floats, float guide, and stem shall be of Type 316 stainless steel. The resilient seat shall be of Buna N. The valve shall be suitable for 150 psig working pressure. Valve shall have standard NPT inlets and outlet ports with diameters as indicated on the Plans. Valve shall be Model 200A Series by APCO Valve and Primer Corporation, Schaumburg, IL, or approved equal.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION AND SHOP COATINGS

A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-6 and painted with two (2) coats of an approved two (2) component coal tar epoxy coating specifically formulated for potable water use. The coating used must appear on the current edition of the United States Environmental Protection Agency’s list entitled “Accepted Categories and Subcategories of Coatings, Liners and Paints for Potable Water Usage.”
B. Exterior ferrous metal surfaces of all buried valves and hydrants shall be blast cleaned in accordance with SSPC SP-6 and given two (2) shop coats of a heavy coat tar enamel or an approved two (2) component coat tar epoxy paint.

3.02 INSPECTION AND PREPARATION

A. During installation of all valves and appurtenances, the Contractor shall verify that all items are clean, free of defects in material and workmanship and function properly.
B. All valves shall be closed and kept closed until otherwise directed by the Engineer or the City.

3.03 INSTALLATION OF BURIED VALVES AND VALVE BOXES

A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.

B. Before backfilling, all exposed portions of any bolts shall be coated with two (2) coats of bituminous paint.

3.04 INSTALLATION OF TAPPING SLEEVES AND VALVES

A. Contact utility owner to coordinate and obtain permission prior to tapping a line. The required procedures and time table shall be followed exactly.
B. Installation shall be made under pressure and flow shall be maintained. The diameters of the tap shall be a minimum of ¼-inch less than the inside diameter of the branch line.
C. The entire operation shall be conducted by workers experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the Contractor.
D. Determine the location of the line to be tapped to confirm that the proposed location will be satisfactory and that no interference will be encountered such as joints or fittings. No tap or sleeve will be made closer than three (3) feet from a pipe joint.
E. A tapping sleeve and valve with boxes shall be set squarely centered on the line to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks or other permanent restraint shall be provided behind all tapping sleeves. Proper tamping of supporting pipe bedding material around and under the valve and sleeve is mandatory for buried installations.
F. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean. All proper regulatory procedures (including disinfection) shall be followed exactly.

3.05 INSTALLATION OF FIRE HYDRANTS

A. Fire hydrants shall be set at the locations as shown on the Plans and bedded on a firm foundation. Hydrants and connecting pipe shall have at least the same depth of cover as the distributing pipe. The hydrants shall be set upon a slab of concrete not less than four (4)-inches thick and 15-inches square. During backfilling, additional screened gravel shall be brought up around and six (6) inches over the drain port. Each hydrant shall be set in true vertical alignment and properly braced.
B. 2,500 psi concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Plans. Eight (8) mil. Polyethylene film shall be placed around the hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO ENSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.
C. All connections from the main to the fire hydrants shall be anchoring mechanical joints designed to prevent movement due to thrust or pressure.
D. The hydrant shall be tied to the pipe with suitable rods or clamps, and shall be coated with Koppers 300 or approved equal at a minimum of 8 mil. thick. Bolts shall have a zinc bolt cover per AWWA. Hydrant paint shall be touched up as required after installation.
E. Fire hydrants shall be factory primed and painted as required by City using a high-grade

enamel.

3.06 FIELD TESTS AND ADJUSTMENTS

A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer or the Representative of the City to demonstrate that each part and all components together function correctly. All testing equipment required shall be provided by the Contractor at his/her sole expense.

END OF SECTION

SECTION 33 3112
WASTEWATER POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to install and test polyvinyl chloride (PVC) pipe and fittings, including excavation, sheeting, storing, dewatering, pipe laying, jointing, testing, backfilling, and any other work that is required or necessary to complete the installation as shown in the Plans as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 1.
B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 REFERENCE STANDARDS

A. All PVC pipe and fittings shall be from a single Manufacturer. The Supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 or ASTM F789 as applicable.
B. Inspections of the pipe may also be made by the Engineer or other representatives of the City after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WASTEWATER PIPE AND FITTINGS

A. Pipe and fittings shall be Type PSM, PVC SDR 26 or 35, as indicated on the Drawings, with full diameter dimensions and shall conform to ASTM D3034, or Type PS-46 PVC conforming to ASTM F789, for sizes 4 through 15-inch and shall conform to ASTM F679 for sizes 18 through 27-inch. Straight pipe shall be furnished in lengths of not more than 13-feet and wyes shall be furnished in lengths of not more than three (3) feet. Saddle wyes will not be allowed.
B. PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Elastomeric gaskets shall conform to ASTM F477.
C. All fittings and accessories shall have bell and/or spigot configurations compatible with the pipe.

PART 3 – EXECUTION

3.01 HANDLING AND CUTTING PIPE

A. Pipe and fittings are slightly brittle. Care shall be taken in shipping, handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction.
B. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
C. All pipe ends shall be square after cutting.
D. While stored, pipe shall be adequately supported from below at not more than three (3) foot intervals to prevent deformation. Pipe shall not be stacked higher than six (6) feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of direct sunlight. Temporary shading as required to meet this requirement shall be

provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

3.02 JOINTING POLYVINYL CHLORIDE (PVC) WASTEWATER PIPE AND FITTINGS

A. PVC wastewater pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the Manufacturer.

3.03 INSTALLATION OF POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the Manufacturer shall be explicitly followed.

B. Any pipe or fittings discovered to be defective after laying shall be removed and replaced with a sound piece.

C. The Engineer or the City may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.

D. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plugs or other approved means.

E. Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM D2321 and as specified herein. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Plans. The specified embedment shall be accurately shaped and trimmed to receive the pipe barrel and each pipe section, when in place, shall have a uniform bearing on the subgrade for the full length of the pipe barrel. Pipe shall not be laid unless the subgrade is free of water and in a satisfactory condition. Adjustments of the pipe to line and grade shall be made by scraping away or filling in with granular material, and not by wedging or blocking up the bell. Blocking under the pipe will not be permitted. The bedding as shown in the details of the Plans shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. The bedding shall then be placed to 12-inches above the top of the pipe. The initial three (3) feet of backfill above the bedding backfill shall be placed in eight (8) inch layers and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial three (3) feet of backfill shall be approved by the pipe Manufacturer's representative prior to use.

F. Joints shall not be "pulled" or "cramped". Each joint of pipe shall be completed in compliance with Manufacturer's recommendations.

G. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

H. Precautions shall be taken to prevent flotation of the pipe in the trench.

I. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting,

shoring or plates are moved, screened material shall be placed to fill any voids created and the screened material and backfill shall be re-compacted to provide uniform side support for the pipe.

J. Pipe stubs for manhole connections shall not exceed 3.25-feet in length unless directed otherwise by the Engineer or the City. Install caps where required. When connecting to an existing manhole, the opening for the connection of the wastewater pipe and the manhole shall be cored using an approved coring machine to the dimensions and size required to install the flexible “SEAL BOOT” resilient connector that meets the requirements of ASTM C-923. The connection shall be watertight when complete.

K. Wastewater mains will be installed in straight trenches from manhole to manhole or manhole to cleanout. There will be no curvilinear installations of wastewater mains.

3.04 TESTING

A. Scope: After sewers and manholes have been installed and backfilled, subject newly laid gravity lines and manholes to a leakage test. Contractor to furnish all labor, materials, tools and equipment to test lines. Take such precautions as required to prevent damage to lines and appurtenances being tested. Repair any damage resulting from test at Contractor’s expense. If required, conduct test in presence of Engineer or designated City Representative.

B. Test Procedures for Leakage Test of Gravity Sewer: Contractor, at his option, may test lines by hydrostatic or low pressure air test as specified below. However, the Engineer may direct a specific test be performed in specified areas of the Project.

C. Exfiltration Test (for Gravity Sewer)

1. Preparation: Seal ends of line section being tested with water tight plugs, equipped with pipe riser inserted and braced in the inlet of the manholes. Fill section with water 24-hours prior to start of test. Fill slowly from downstream manhole in test section so that no air is trapped in the line. Leave outlets of stacks and service lines exposed and unplugged until after exfiltration test has been made. Outlets terminating below level of test water surface to be temporarily extended upward by installing additional lengths of pipe. After completion of satisfactory test, remove lengths of pipe added for test.
2. Duration of Test: Test for 24-hours. Minimum head of either two (2) feet measured above the crown, inside pipe at upper end of section or four (4) feet measured above trench water table, whichever is higher, so that a net positive of two (2) feet is used for testing.
3. Allowable Leakage: Allowable leakage or exfiltration in any individual section under construction shall not exceed 25 gallons per inch of inside diameter per mile of pipe per 24 hours.

D. Low Pressure Air Test of Plastic Gravity Flow Wastewater Lines

1. General:
   Wastewater lines, at the discretion of the ENGINEER, shall be air tested between manholes. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous, test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

   All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure.
   Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.
2. Ground Water

Since the presence of ground water will affect the test results, test holes shall be dug to the pipe zone at intervals of not more than 100 feet and the average height of ground water above the pipe (if any) shall be determined before starting the test.

3. Test Procedure
The ENGINEER may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi and an accuracy of 0.0625 psi. (One ounce per square inch.) All air used shall pass through a single control panel.
Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

Add air slowly to the section of sewer being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average backpressure of any ground water that may submerge the pipe. Compare the time recorded with the specification time for the size and length of pipe as given in the following table:

Table for Low Pressure Air Testing of Plastic Pipe:

Minimum Specified Time Required For 1.0 psig Pressure Drop for Size and Length of Pipe Indicated								
Diameter of Pipe, (in.)	Specification Time (min: sec) for length shown							
	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

NOTES: 1. Specification times are as given in UNI-B-6 RECOMMENDED PRACTICE FOR LOW- PRESSURE TESTING OF INSTALLED PIPE -- by Uni-Bell PVC Pipe Association, 2655 Villa Creek Dr., Ste. 155, Dallas Texas 75234.

Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above table shall be cause for rejection. When the line tested includes more than one size pipe, the minimum time shall be that given for the largest size pipe included.

E. Deflection Testing
1. Deflection tests shall be performed on all flexible pipes. For pipes with inside diameters

less than 27-inches, a rigid mandrel shall be used to measure deflection. The test shall be conducted after final backfill has been in place at least 30 days in the presence of a representative of the City's Utilities Department. No pipe shall exceed a deflection of five percent (5%). If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. Test shall be performed without mechanical pulling devices.

2. Mandrel Sizing: The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter of the pipe minus two minimum wall thickness for O.D. controlled pipe and the average inside diameter for the I.D. Controlled pipe, all dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
3. Mandrel Design: The rigid mandrel shall be constructed of a metal or rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

F. Repairs of Lines:
Remove and replace or make approved corrective repairs to any section of line or manhole which has leakage that exceeds above amounts. Repair any individual leaks that may appear whether or not overall section meets leakage requirements. Individual leaks will ordinarily be revealed by looking through sewer with a light while groundwater level is over sewer, during water tamping operations or immediately after water leakage is emptied from sewer.

G. Retest:
Sewers and/or manholes failing to meet requirements of leakage test will, after repair by Contractor, be tested again for leakage. No sewer or manhole will be accepted until leakage is less than allowable amount.

H. Video Inspection
1. The use of a television camera for inspection prior to placing the sewer in service will be performed if required by the Owner. Video inspection is at the cost of the Contractor, and copies of the videotapes will be presented to the City prior to final acceptance. One (1) copy of the videotapes shall be submitted to the City.
2. Post construction video of the gravity wastewater lines will be evaluated on a case-by-case basis for acceptance. Preparation for videotaping of wastewater line shall be as follows:
    a. Flush and clean the gravity wastewater line prior to videotaping.
    b. The videotape shall display the station, in accordance with the Plans and Standards, and counter on the screen. Manhole numbers and stations shall correspond to the contract documents.
    c. If debris is evident in the line during the video, the line will be flushed and cleaned to allow a clean video.
    d. All manholes will be identified at the beginning and end of the video corresponding to contract documents with upstream and downstream ends identified.

END OF SECTION

SECTION 33 3913
WASTEWATER CONCRETE MANHOLES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to install precast concrete manholes, frames and covers, and appurtenances as shown on the Plans and as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 1.
B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)
   1. ASTM A48 - Specification for Gray Iron Castings.
   2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM C33 - Specification for Concrete Aggregates.
   4. ASTM C150 - Standard Specification for Portland Cement.
   5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
   6. ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials.
B. American Concrete Institute (ACI)
   1. ACI 318 - Building Code Requirements for Reinforced Concrete.
   2. ACI 350R - Concrete Sanitary Engineering Structures.
C. American Association of State Highway and Transportation Officials (AASHTO)
   1. Standard Specifications for Highway, Streets and Bridges.
D. Occupational Safety and Health Administration (OSHA)
E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. All material shall be new and unused.
B. Materials' quality, manufacturing process and finished sections are subject to inspection and approval by Engineer or other City representative.
C. Materials will be examined for compliance with ASTM specifications, these Specifications and approved Manufacturer's drawings. Additional inspection criteria shall include: appearance, dimensions(s), blisters, cracks and soundness.
D. Materials shall be rejected for failure to meet any Specification requirement. Mark for identification rejected materials and remove from work site immediately. Rejected materials shall be replaced at no cost to Owner.
E. Repair minor damage to precast concrete sections by approved method, if repair is authorized by Engineer or the City.

PART 2 – PRODUCTS

2.01 GENERAL

A. Reference to a Manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
B. Like items of materials/equipment shall be the end products of one Manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and Manufacturer's service.

C. Provide lifting lugs or holes in each precast section for proper handling.

2.02 PRECAST CONCRETE MANHOLE SECTIONS

A. Precast concrete base sections, riser sections, transition top sections, flat slab tops and grade rings shall conform to ASTM C478 and meet the following requirements:
   1. Bottom slab thickness shall be 12-inches.
   2. Base, riser and transition top sections shall have tongue and groove joints.
   3. Sections shall be cured by an approved method.
   4. Precast concrete sections shall be shipped after concrete has attained 3,000 psi compressive strength.
   5. Design precast concrete base, riser, transition top, flat slab top and grade ring for a minimum HS-20 loading plus earth load. Calculate earth load with a unit weight of 130 pounds per cubic foot.
   6. Mark date of manufacture, name and trademark of Manufacturer on the inside of each precast section.
   7. Construct and install precast concrete base as shown on the Plans.
   8. Provide integrally cast knock-out panels in precast concrete manhole sections at locations, and with sizes shown on Plans. Knock-out panels shall have no steel reinforcing.

B. Manhole diameter shall be as shown on the Plans, but not less than the diameter of the largest connecting pipe plus two (2) feet.

C. Pipe Sections:
   1. Pipe sections shall conform to current specifications for Precast Reinforced Manhole Sections, ASTM Designation C478.
   2. Minimum wall thickness for the manhole risers shall be as listed under Wall “B” in the “Class Tables” of ASTM C76 for Class III pipe.

D. Joints
   1. Joints shall conform to the joint specifications in ASTM C478, C76, and ASTM C443. All manhole sections, including the bottom section, shall be furnished with “O-ring” type rubber gasket joints. The joints shall be furnished and installed with the bell down to resist groundwater infiltration. All joints shall be sealed with mortar or an approved non-shrink grout on the inside and the outside of the manhole. Grade rings shall be mortared to each other and on the inside and outside to provide a waterproof seal.

E. Manhole Steps
   1. Unless specifically approved by the City, manhole steps shall not be provided.

2.03 MANHOLE FRAME AND COVER

A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30.

B. Manhole covers shall have a diamond pattern, pickholes and the word SEWER as appropriate cast in three (3) inch letters. Manhole frame and covers shall be Neenah Foundry, Western Iron Works, Vulcan Foundry, or equal.

2.04 JOINTING PRECAST MANHOLE SECTIONS

A. Seal tongue and groove joints of precast manhole sections with rubber “O”-ring gasket. O-ring gasket shall conform to ASTM C443.

B. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

2.05 PIPE CONNECTIONS TO MANHOLE

A. Connect pipe to manhole in the following ways:
   1. Flexible sleeve - Integrally cast sleeve in precast manhole section or install sleeve in a formed or cored opening. Fasten pipe in sleeve with stainless steel clamp(s). Coat stainless steel clamp(s) with bituminous material to protect from corrosion. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve; Kor-N-Seal connector; PSX Press-Seal Gasket or equal.
   2. Compression gasket - Integrally cast compression gasket in precast manhole section. Insert pipe into compression gasket. Compression gasket shall be A-Lok, or equal.

PART 3 – EXECUTION

3.01 MANHOLE INSTALLATION

A. Manholes shall be constructed to the dimensions shown on the Plans and as specified herein. Protect all work against flooding and flotation.
B. Place manhole base on a bed of screened gravel eight (8) inches in depth as shown on the Plans. Set manhole base so that a maximum grade adjustment of eight (8) inches is required to bring the manhole frame and cover to final grade. Use precast concrete grade rings to adjust manhole frame and cover to final grade.
C. Set precast concrete barrel sections plumb with a ¼-inch maximum out of plumb tolerance allowed. Seal joints of precast barrel sections with either a rubber “O” ring set in a recess or preformed flexible joint sealant in sufficient quantity to fill 75 percent of the joint cavity. Fill the outside and inside joint with non-shrink mortar and finished flush with the adjoining surfaces. Caulk the inside of any leaking barrel section joint with non-shrink grout.
D. Allow joints to set for 14 hours before backfilling unless a shorter period is specifically approved by the Engineer or the City.
E. Plug holes in the concrete barrel sections required for handling with a non-shrinking grout or non- shrinking grout in combination with concrete plugs. Finish flush on the inside.
F. Core holes in precast sections to accommodate pipes prior to setting manhole sections in place to prevent jarring which may loosen the mortar joints.
G. Backfill carefully and evenly around manhole sections.

3.02 MANHOLE PIPE CONNECTIONS

A. Construct manhole pipe connections, including pipe stubs, as specified above. Close or seal pipe stubs for future connections with a gasketed watertight plug.

3.03 SETTING MANHOLE FRAME AND COVER

A. Set manhole covers and frames in a full mortar bed. Utilize precast concrete grade rings, a maximum of eight (8) inches thick, to assure frame and cover are set to the finished grade. Set manhole frame and cover to final grade prior to placement of permanent paving.

3.04 MANHOLE TESTING

A. If required, Contractor shall schedule testing such that Engineer or the City’s representative can observe each test.

B. Test Procedures for Hydrostatic Test for Manholes
   1. Manholes shall be tested for leakage separately and independently of the wastewater lines by vacuum testing, or other methods acceptable to the Engineer. If a manhole fails a leakage test, the manhole must be made water tight and retested. The maximum leakage for hydrostatic testing shall be 0.025 gallon per vertical foot per hour. Alternative test methods must ensure compliance with the above allowable leakage. Hydrostatic exfiltration testing shall be performed as follows: all wastewater lines coming into the manhole shall be sealed with an internal pipe plug, then the manhole shall be filled with water and maintained full for at least one (1) hour. For concrete manholes, a wetting period of 24-hours may be used prior to testing in order to allow saturation of the

concrete.

C. Test Procedures for Vacuum Testing Manholes

1. Where groundwater is present, manholes shall be tested by vacuum. Manholes testing by vacuum shall be performed by the Contractor in compliance with these specifications.
2. Manholes shall be tested after installation of all connections (existing and/or proposed) in place. All lift holes shall be plugged with an approved non-shrink grout and all drop connections and gas sealing connections shall be installed prior to testing. The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole. The plugs shall be installed in the lines beyond the drop- connections, gas sealing connections, etc. The test head shall be placed inside the frame at the top of the manhole and inflated in accordance with the manufacturer's recommendations. A vacuum of 10-inches of mercury shall be drawn, and the vacuum pump shall be turned off. With the valve closed, the level of vacuum shall be read after the required test time. If the drop in the level is less than one (1) inch of mercury (final vacuum of nine (9) inches of mercury), the manhole will have passed the vacuum test. The required test time shall be 90- seconds.
3. Manholes which have a final vacuum of nine (9) inches of mercury after the time indicated will be accepted. If there has been no pressure loss during the first 75-seconds the test may be stopped and the manhole will be accepted. Any manhole which fails the vacuum test as described above shall be repaired with an approved non-shrink grout or other material acceptable to the Engineer and the City based on the material from which the manhole is constructed. The manhole shall be retested as described above until a successful test is made.

3.05 CLEANING

A. Thoroughly clean all new manholes of all silt, debris and foreign matter of any kind, prior to final inspections.

END OF SECTION

SECTION 33 4100
STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Site storm sewer drainage piping, fittings, accessories, and bedding.
   2. Catch basins, paved area drains, site surface drains and stormwater detention facilities.
   3. Connection of building storm water drainage system.
   4. Precast concrete, Cast-in-place concrete manholes.

B. All public work to be performed and materials to be used within the street right-of-way, shall be in accordance with the City of Conroe Design Standards. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the plans, the City Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.02 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.
B. HDPE: High density polyethylene.
C. RCP: Reinforced concrete pipe

1.03 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-foot head of water (30 kPa). Pipe joints shall be at least silttight, unless otherwise indicated.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Pipe materials, fittings, and accessories.
   2. Drains.

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes according to manufacturer's written rigging instructions.
D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of service.

PART 2 – PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings; NPS 6” to 12” ASTM D 3034, SDR 26, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.02 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), with groove and tongue ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.
   1. Class III, Wall B.

2.03 HDPE PIPE AND FITTINGS

A. Pipe shall have a smooth interior and exterior corrugations.
   1. 4-through 10-inch (100 to 250 mm) shall meet AASHTO M252m, Type S.
   2. 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or ASTM F2306.

B. Pipe shall be joined with joints meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306.

C. 4-through 60-inch (100 to 1500mm) shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

D. 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance shall be installed by the manufacturer.

E. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306.

F. To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM C969. Appropriate safety precautions must be used when field-testing any pipe material.

G. Installation shall be in accordance with ASTM D2321 and manufacturer’s published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot. (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 ft. (0.6 m) in single run applications.

2.04 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Dissimilar Pipes: ASTM D 5926, PVC, or other material compatible with pipe materials being joined.

2.05 CLEANOUTS AND PLUGS

A. Installation shall be in accordance with the details and at locations shown on the drawings.

B. All cleanouts shall have a 2’ x 2’ x 6” thick concrete apron.

2.06 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
   2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
   4. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
   5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
   7. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
   8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
   9. Manhole Frames and Covers: Ferrous; 28-inch ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 30-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
      a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Ballast: Increase thickness of concrete, as required to prevent flotation.
   2. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
   3. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
   4. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
   5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
   6. Manhole Frames and Covers: Ferrous; 28-inch ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 30-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
      a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
      b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

2.07 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.08 CATCH BASINS

A. Installation shall be in accordance with the details and at locations shown on the drawings.

2.09 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to the details and at locations shown on plans.

B. Frames and Grates: Heavy-duty frames and grates according to the details and at locations shown on plans.

PART 3 – EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
   a. Unshielded flexible couplings for same or minor difference OD pipes.
   b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: As shown on plans.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
2. Install piping with 36-inch (915-mm) minimum cover.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
    a. Install HDPE pipe according to ASTM D2321.

3.04 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
3. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
2. Use extra-heavy-duty, top-loading classification cleanouts in fire lane areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 24 by 24 by 6 inches deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.06 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
2. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch (102-mm) minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch (102-mm) minimum concrete around bottom and sides.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections according to ASTM C 891.
C. Construct cast-in-place manholes as indicated.

3.08 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.09 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
B. Install outlets that spill onto grade, anchored with concrete, where indicated.
C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
D. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.
B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

CSP# 2026-06

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