

PROJECT MANUAL



2025 Multi-Campus Chiller Replacement

Cypress-Fairbanks Independent School District
Cypress, Houston and Jersey Village, Texas



MORE THAN ARCHITECTS

PROJECT MANUAL

Project Name: 2025 Multi-Campus Chiller Replacement
Client Name: Cypress-Fairbanks Independent School District Location: Cypress, Houston and Jersey Village, Texas
Project Number: 1818-08-01,02,03,04 Date: August 11, 2025

All inquiries shall be forwarded to Patrick Reid, Huckabee; Patrick.reid@huckabee-inc.com; 800.687.1229.

PROJECT TEAM



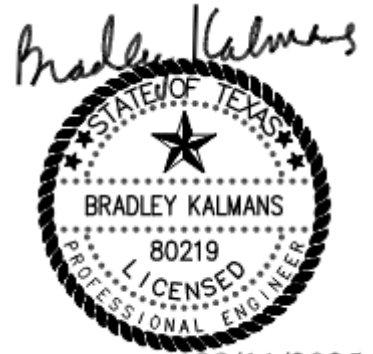
STRUCTURAL ENGINEER:

Innovative Engineering Group, Inc., F-5923
R. Craig McKee, PE
800.687.1229



ARCHITECT: 08/11/2025

Huckabee & Associates, Inc.
Susan F. Wisa, AIA 24614
800.687.1229



MECHANICAL/ELECTRICAL ENGINEER: 08/11/2025

Salas O'Brien
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281.664.1900

Huckabee

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END OF SECTION

REQUEST FOR COMPETITIVE SEALED PROPOSALS

OWNER: Cypress-Fairbanks Independent School District
11440 Matzke Rd.
Cypress, Texas 77429
Representative: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

PROJECT: **2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements**
CFISD Proposal Number: 25-03-5755-R-RFP

PROPOSED CONSTRUCTION BUDGET: \$ 10,000,000.00

PROPOSAL DATE AND TIME: **Tuesday, August 26, 2025** Base Proposal: 2:00 PM
Alternate Proposal: 3:00 PM

AA - 1

Proposal Documents will be available on/after **Monday, August 11, 2025**. General Contractor Offerors may obtain digital drawings and specifications. Additionally, General Contractor Offerors must submit a fully executed AIA Document A305, Contractor's Qualification Statement to the office of the Architect at the time proposal documents are obtained.

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

ISqFt Plan Room (AGC)
8450 Westpark, Ste. 100
Houston, Texas 77063
Ph: (713) 843-3700 Fx: (713) 843-3701

McGraw-Hill Construction/ Dodge Data & Analytics
www.dodgeplans.construction.com or contact Toni.Lawson@construction.com Ph: (281) 460-5730

All proposals must be in the hands of the Owner no later than the time specified above. Please seal all proposals in duplicate in an envelope with the following information on the face of the envelope.

Name of Offeror (General Contractor)
2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements
Cypress Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: **25-03-5755-R-RFP**
_____(Name of Bonding Company)
Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

The Owner reserves the right to reject any and all proposals and to waive any informality in the Competitive Sealed Proposal process. No proposal shall be withdrawn within sixty (60) days after the proposal opening without the specific consent of the Owner. Refer to Offerors Section Document AB.

SELECTION CRITERIA: Selection criteria are included in Document AB of the Project Manual and Selection Criteria and are available on request by perspective Offerors from the office of the Architect.

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

PAYMENT BOND AND PERFORMANCE BOND: A Payment Bond and Performance Bond, each in an amount equal to 100% of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Refer to Section AB, Instructions to Offerors for detailed Bond requirements.

The prevailing rates of wages as stipulated in the Supplementary Conditions here within are the minimums that must be paid in conformance with all applicable laws of the State of Texas.

All Offerors (General Contractors) submitting proposals are encouraged to attend the proposal opening and visit the Project site.

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare their proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and Supplier Offerors desire to purchase individual drawings and specification sections for their proposal convenience, they may do so by ordering the specific drawings and specifications directly from the reproduction company. Each offeror purchasing a partial set of proposal documents is responsible for determining exactly which documents he requires and is responsible for all costs associated with printing and delivery.

Project No. 01818-08-01 to 01818-08-02,
01818-08-03, & 01818-08-04

Subcontractors and Suppliers exercising this option must agree to do so on the basis that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal and 2) documents shall not be used on other construction projects. Successful Subcontractors and Supplier Offerors may retain their Proposal Documents until completion of the construction. The subcontractor/supplier is responsible for all the associated work and coordination when not obtaining a complete set of drawings.

END OF DOCUMENT

- C. The Offeror agrees to comply with the requirements of the following paragraph. These requirements are absolute, and any Offeror who subsequently does not agree to comply with these requirements will automatically disqualify himself from proposing or receiving award of the contract.
- D. The Offeror agrees that:
 - 1. Work on the project will begin immediately upon the General Contractor's receipt of CFISD's Notice to Proceed. The NTP will be accompanied by CFISD's purchase order.
 - 2. On-site mobilization will not begin until after the Bonds and Certificate of Insurance have been reviewed and approved by the Owner and that timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror.
 - 3. Offeror will participate as a team member in cooperation with the Owner and Architect.
 - 4. The Offeror will assign competent full-time superintendents and that these superintendents shall be maintained on the project for the duration of the project including completion of all punch list items, subject only to their continuous employment.
 - 5. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the greatest amount proposed.
 - 6. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.
 - 7. Offeror and its subcontractors shall comply with requirements listed in Document BD, Insurance and Bonds Requirements for Contractors and Facility Renters.
 - 8. Each Offeror by making their Proposal represents that their Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
 - 9. Each Offeror by making their Proposal represents that their Proposal includes the employment of Subcontractors that meet or exceed the Installer Qualifications described in the Project Manual.
 - 10. Each Offeror (and sub-Offeror or supplier submitting a proposal to an Offeror) shall submit an affidavit stating that no asbestos, PCBs or lead building materials will be incorporated into the Work.

3. PROPOSAL DOCUMENTS

- A. Proposal Documents include the Proposal Forms, Contract Forms, Specifications, Drawings, Addenda and documentation as noted in AIA Document A201TM-2017, as amended.

4. INTERPRETATION OF PROPOSAL DOCUMENTS

- A. Offerors and sub-Offerors requiring clarification or interpretation of the Proposal Documents shall make a written request using the form bound in the Project Manual, which shall reach the Architect at least ten (10) days prior to the date for receipt of proposals.
- B. Any interpretation, correction or change of the Proposal Documents will be made by Addendum. Interpretations, corrections or changes of the Proposal Documents made in any other manner will not be binding.

5. SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

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

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

6. ASBESTOS, LEAD AND PCB CONTAINING MATERIALS, PRODUCTS AND SYSTEMS

- C. Prior to payment of Retainage and Final Payment, the Contractor and all subcontractors shall furnish a notarized statement certifying that no asbestos/PCB's, or asbestos/PCB-containing materials have been used in this Project.

7. INSURANCE

- A. Each Offeror shall include in his proposal the complete cost for insurance required under the Amended General Conditions, Supplementary Conditions and Specification Document BD, Insurance and Bond Requirements for Contractors and Facility Renters. Coverage shall remain in full force for the duration of the Project.

8. PERFORMANCE BOND AND PAYMENT BOND

- A. Each Offeror shall include in his base proposal, the premium costs for 100% Performance Bond and 100% Payment Bond. Bonds shall be written by a Surety Company included in the latest State Board of Insurance, Bond Department's "List of Insurance Companies Licensed to Write Fidelity and Surety Bonds in Texas, and the latest United States Department of the Treasury's Listing of Approved Sureties (Department Circular 570). The Owner reserves the right to make inquiries about the current financial stability of the Surety, including demands for proof of sound reinsurance, proof that claims are being met, and current financial information. The Owner reserves the right to reject Bonds written by a Surety that, in the Owner's judgment, does not provide proof of sound reinsurance and or does not provide proof that claims are being met.

9. PROPOSAL PROCEDURES

- A. A proposal is invalid if it has not been received at the designated location prior to the time and date for receipt of proposals indicated in the Request for Competitive Sealed Proposals, or prior to any extension thereof issued to the Offerors by Addenda.
- B. All requested Alternates shall be proposed. If no change in the Base Proposal is required, enter "No Change".

- C. Prior to the receipt of Proposals, Addenda will be transmitted to each person or firm recorded by the Architect as having received the proposal documents in accordance with the Request for Competitive Sealed Proposals, and will be available for inspection wherever the proposal documents are available for that purpose.
- D. Proposals must be submitted in duplicate and only on the Proposal Forms included in the Project Manual, in sealed envelopes addressed as follows:

Name of Offeror (General Contractor)

Competitive Sealed proposal for:

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

Cypress-Fairbanks Independent School District

Cypress-Fairbanks ISD Proposal Number: **25-03-5755-R-RFP**

Name of Bonding Company

Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction
Facilities, Planning & Construction
11430-B Perry Road
Houston, Texas 77064

- E. All proposals must be delivered sealed to the above address stipulated in the Request for Competitive Sealed Proposals at or before the time and date set. Proposals will be received at no other place. If Proposal is sent by U.S. Mail, it must be sent Registered Mail.
- F. The Owner reserves the right to reject any Proposal if the evidence submitted by, or investigation of, such Offeror fails to satisfy the Owner that such Offeror is properly qualified to carry out the obligations of the contract and to complete the work therein. Conditional proposals will not be accepted. Award may be made to other than the low-dollar Offeror and given to the one offering the "best value" to the school district, in addition to the purchase price, based on the published selection criteria and on its ranking evaluation.
- G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such written request is received by the Owner at the place designated for receipt of proposals and prior at least forty-eight (48) hours before the time fixed for the opening of proposals. The Proposal Bond will be returned with the proposals if withdrawn in accordance with the above. The withdrawal of a proposal does not prejudice the right of the Offeror to file a new proposal at the time and place stated. No proposal may be withdrawn after the time fixed for the opening of proposals for a period of sixty (60) days.

10. SUBMISSION OF ADDITIONAL PROPOSAL INFORMATION

- A. The Offeror shall submit with his Alternate Proposals:
 - 01 Proposal Form AC Alternates
 - 02 An experience profile (resume) of the proposed superintendent(s) and project manager(s). These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror's proposal.
 - 03 The firm names of the major subcontractors and/or suppliers requested on the Alternate Proposal Form AF.
 - 04 Signed and Notarized Special Owner Requirements Sections 01 35 23 and 01 35 23.1.
 - 05 An experience profile (resume) of the Offeror, including a list of projects completed of similar size and scope. These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror's proposal.

11. FELONY CONVICTION NOTIFICATION

- A. Each Offeror shall execute and submit Form AE, Statement of Affirmation within the sealed envelope containing the Base Proposal.
- B. Section 44.034, of the Texas Education Code requires a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. Subsection (b) states “a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract.” Subsection (c) states “this section does not apply to a publicly held corporation”.

12. PROPOSAL EVALUATION WAIVER

- A. Each Offeror shall execute and submit Form AG, Proposal Evaluation Waiver within the sealed envelope containing the Base Proposal.
- B. All Offerors shall agree to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The Offeror further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

13. AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

- A. Each Offeror shall execute and submit Form AH, Affidavit of Non-Discriminatory Employment within the sealed envelope containing the Base Proposal.
- B. All Offerors, Contractor and subcontractors shall agree to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and Rules and Regulations issued in order to maintain and insure non-discriminatory employment practices.

14. CONFLICT OF INTEREST QUESTIONNAIRE

- A. Each Offeror shall execute an on-line Conflict of Interest Questionnaire and submit Form AN within the sealed envelope containing the Base Proposal.

15. PROPOSAL SECURITY

- A. No proposal will be considered unless it is accompanied by a Certified or Cashier's Check or Proposal Bond executed on the form attached. In either case the amount shall be **not less than ten percent (10%) of the greatest amount proposed (considering alternates, if any)**. The proposal security shall insure the execution of the contract and the furnishing of acceptable Performance Bond, Payment Bond and Certificates of Insurance by the successful Offeror within ten (10) days after notification of award to such Offeror and that this proposal will not be withdrawn within sixty (60) days after date of opening of proposals without the consent of the Owner. Proposal Bond shall be submitted on AIA Document A310™-2010 or on Form AD included in the Project Manual.
- B. Proposal Security shall be submitted within the sealed envelope containing Alternate Proposals.
- C. Withdrawal of a proposal by an Offeror, or refusal to enter into negotiations and/or acceptance of a contract for construction by an Offeror after the opening of proposals and within and including the

sixtieth day after proposals shall subject the Offeror to the forfeiture of his proposal security to the Owner.

16. SUBMISSION OF POST PROPOSAL INFORMATION

- A. Each Offeror shall submit, by **5:00P.M. on Tuesday, August 26, 2025**, following documentation to the office of the Architect. The post proposal information submitted by the Offeror will be considered by the Selection Committee in the evaluation of the Offeror's proposal:
1. A bar-chart construction schedule delineating construction phasing including major construction milestone dates.
 2. A statement describing the Offeror's proposed management concept for the Project.
 3. A statement of all Work to be self-performed by the Offeror.
 4. Complete and fully executed Contractor Qualification Statement Form, AIA Document A305, for each of the subcontractors named on the Offeror's Alternate Proposal Form. Qualification statements must include a listing of past projects performed by the subcontractor that are of similar size and scope to the Project. Past project information must include the names and telephone numbers of the respective Owner's and Architect's representatives for those projects.
 5. Any voluntary Value Engineering items that the proposer would believe to be of interest to the Owner. (This VE list will not be considered part of the evaluation process and is entirely voluntary.)
 6. As part of post proposal negotiations the Owner may desire to discuss a voluntary option that would establish the amount to be added to the owner's contingency allowance as an incentive amount offered by the general contractor and identified sub-contractors for early payments made by the owner to the general contractor on or before the 15th day of each month following the specified billing period. In addition, General Contractor agrees to maintain timely payments to subcontractors upon payment to the general contractor by the owner. This incentive is made to the owner as a lump sum for each trade contract participating, the proposed amount offered is for the duration of the contract and shall be allocated on a percentage complete of total contract value per month per contractor or subcontractor offering the incentive for early payment. The amount of the incentive each month shall be the proposed value by trade for the incentive multiplied by the percentage completed that month of that trade or generals total contract, if the owner makes payment to the general contractor on or before the 15th day of the month following the billing period then the incentive would be recognized as a credit to the owners contingency allowance, if the payment is not made on or before the 15th by the owner then the incentive credit to the Owner that month would not be applied.
- A value for this incentive for the general contractor and the proposed list of subcontractors and values proposed for each that want to participate in this option will be submitted by the highest ranked proposer during post proposal negotiations.
- B. The selected Offeror shall execute From AL, Certification of Project Compliance, and submit at Project Closeout.
- C. The selected Offeror shall execute and submit Form AP, Certification of Criminal History Record Information within 10 days after receipt of Notice to Proceed and prior to commencement of Work.

17. REJECTION OF PROPOSALS

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

18. EVALUATION OF PROPOSALS

- A. The Owner may discuss proposals with Offerors after the proposal opening, to allow for clarification.
- B. The Owner shall endeavor to prevent non-monetary information from competing proposals being disclosed to other Offerors.
- C. The Owner will, within forty-five (45) days after the proposal opening, evaluate and rank each proposal submitted relative to the selection criteria.
- D. The Owner's Selection Committee will select the Offeror that offers the best value based on the selection criteria and the Selection Committee's ranking of the proposals.
- E. The Owner and Architect may discuss options with the selected Offeror for cost reduction and/or other Contract terms. If the Owner is unable to come to terms with the first ranked Offeror, discussions are to terminate and the Owner will proceed to the next ranked Offeror and repeat the process until a contract agreement is reached or all proposals are rejected.

19. DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

- A. In determining the Selected Offeror, the Owner will evaluate the information derived from the Offeror's (Contractor's) Qualification Statement, information received from completed Offeror's reference surveys, direct experience with the Offeror by Selection Committee members, the Offeror's proposal including information requested with the proposals and post proposal information submitted by the Offeror relative to the following Selection Criteria. A maximum of **one hundred twenty (120) points** may be scored to each proposal.

1.	Purchase Price – The purchase price will be scored mathematically as a weighted percentile score utilizing the proposal submitted and the weighted value of the criterion	40
2.	Reputation – Offeror and the Offeror’s goods and services for projects of similar size and scope	10
3.	Quality – Offeror and the Offeror’s goods and services for projects of similar size and scope	10
4.	Completion – Offerors past record of completing projects of similar size and scope on time and within budget	10
5.	Warranty – Offeror’s response to warranty work requests, the quality of the warranty work, and the Offeror’s record of monitoring and reporting back to the Owner on the progress of warranty work	10
6.	Close Out – Offeror’s record of closing out projects expeditiously	10
7.	Project Team – The qualifications of the Offeror’s proposed project manager(s) and project superintendent(s)	10
8.	Subcontractors – The qualifications of the Offeror’s proposed subcontractors	20
	Total:	120

The Selection Committee consisting of Cypress-Fairbanks ISD administrators, architects, consultants and other staff will make an initial evaluation of the proposals. Its recommendation will be considered by the Cypress-Fairbanks ISD Board of Trustees (“Board”). The District reserves the right to review the recommendation with the Asst. Supt. of Facilities & Construction, the Director of Construction Field Services, the Director of Design and Facilities Planning, and the Director of Project Management and others deemed appropriate by the District prior to review by the entire

Board. The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.

20. AWARD OF CONTRACT

- A. The Owner's Selection Committee's recommendation based on an evaluation and ranking of each proposal submitted in relation to the selection criteria will be presented to the Board of Trustees for approval and award of the contract for construction. Presentation of the Selection Committee's recommendation is anticipated to occur during the Board of Trustees' meeting on **September 8, 2025**.
- B. The Owner or the Architect, on behalf of the Owner, will issue a written Notice to Proceed after award of the contract for construction by the Board of Trustees.
- C. The selected Offeror shall submit to the Owner, for review and acceptance, a Performance Bond, a Payment Bond and Certificates of Insurance within ten (10) calendar days after receipt of a written Notice to Proceed.
- D. All Offerors shall hold pricing of all alternates open for consideration and acceptance by the District/Owner as noted on Alternates proposal form.

21. ON SITE MOBILIZATION

- A. The selected Offeror shall not commence on-site work under this Contract until he receives a written confirmation from the Owner approving the Performance Bond, Payment Bond and Certificates of Insurance. Timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror. Additional review time by the Owner due to Contractor's failure to do so will not constitute grounds for delay claims.

22. CONTRACT TIME AND LIQUIDATED DAMAGES

- A. Refer to the AIA Document A201™-2017, as Amended for Contract Time and Liquidated Damages provisions of the Contract.

23. AVAILABILITY OF MATERIALS AND SYSTEMS

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

EXHIBIT A

REFERENCE LISTING FOR Cy-Fair ISD

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

OFFEROR NAME: _____

PROJECT No. 1	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	or Email: _____

PROJECT No. 2	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	or Email: _____

PROJECT No. 3	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	Or Email: _____

END OF SECTION

FORM AC
COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 25-03-5755-R-RFP
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: _____

Date: _____ Phone No.: _____

To: Board of Trustees
Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **Huckabee Architects** dated **August 11, 2025**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold Base Proposal open for acceptance sixty (60) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. BASE PROPOSAL

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

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

II. ALLOWANCES

Undersigned certifies that the allowances specified in Section 01 21 00 are included in the Base Proposal and agrees that unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

III. CONTRACT TIME

By submittal of this proposal, the undersigned stipulates that the Base Proposal includes all costs necessary to attain Substantial Completion of the Work on or before the date stipulated in AIA Document A101™-2017.

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 2:00 PM, August 26, 2025
COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL

IV. ADDENDA

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

V. CHANGES IN THE WORK

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

VI. LIQUIDATED DAMAGES

By submittal of this proposal, the undersigned stipulates an agreement that if Substantial Completion of the Work is not attained on or before the date stipulated in AIA Document A101™-2017, the undersigned and his Surety shall be liable for and shall pay the Owner the sums stipulated as Liquidated Damages as defined in AIA Document A201™-2017.

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

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

Authorized Signature

Printed Name

Title

Name of Contracting Firm

Address

Telephone

Date

FORM AC
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSALS

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 25-03-5755-R-RFP
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: _____

Date: _____ Phone No.: _____

To: Board of Trustees
Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **Huckabee Architect**, dated **August 11, 2025**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold Alternate Proposal open for acceptance one hundred twenty (120) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. ALTERNATES

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

A. Alternate Number 1 – **Base Bid Adjustment**

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

B. Alternate Number 2A – **Berry Center Chillers by Daiken**

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

C. Alternate Number 2B – **Berry Center Chillers by Trane**

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

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, August 26, 2025
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

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

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

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

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

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

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

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

III. CONTRACTOR'S PROJECT TEAM MEMBERS

The undersigned proposes the following project team members (include resumes):

Project Manager _____

Superintendent

Asst. Superintendent(s) _____

Project Engineer

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, August 26, 2025

COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

PROPOSAL BOND

FORM AE

FELONY CONVICTION NOTIFICATION

Note: The Statement of Affirmation Must Be Notarized

STATEMENT OF AFFIRMATION

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

Firm's Name: _____ Address: _____

“a. ____ My firm is a publicly held corporation, therefore, this reporting requirement is not applicable.”

“b. ____ My firm is not owned nor operated by anyone who has been convicted of a felony.”

“c. ____ My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:”

Name of Felon(s)

Details of Conviction(s) _____

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

Offeror's Printed

Name _____ Position/Title _____

Offeror's

Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____, 20____.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL

END OF FORM

FORM AF

LIST OF SUBCONTRACTORS

PROJECT: **2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements**

ARCHITECT: **Huckabee, Inc.**

(Name, address) Cypress-Fairbanks Independent School District
Cy-Fair I.S.D. Proposal Number: **25-03-5755-R-RFP**
Houston, Harris County, Texas

TO: (General Contractor)

DATE:

The undersigned proposes the following subcontractors. Note – Not all trades listed below will apply to every project.

Paving:
Abatement:
Dampproofing/insulator:
Masonry:
Roofing:
Drywall:
Casework:
Concrete:
Plumbing:
Mechanical:
Electrical:
Fire Alarm:
Sprinkler:
Low Voltage/Security:
Site Utilities:
Earthwork/Site Prep:
Fencing:
Pre-Engineered Metal Bldg:
Glazing:
Hardware:

FORM AG

PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The proposer further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

NOTE: The Statement of Affirmation Must Be Notarized.

STATEMENT OF AFFIRMATION

“The undersigned affirms that he/she is duly authorized to execute this waiver by the person(s) or business entity making the proposal.”

Firm's Name _____ Address: _____

Proposer's Printed
Name _____ Position/Title _____

Proposer's
Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL.

END OF FORM

FORM AH

AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

STATE OF TEXAS)
)
COUNTY OF HARRIS)

AFFIDAVIT

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

SIGNED: _____

DATE: _____

PRINTED NAME: _____

TITLE: _____

COMPANY: _____

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF _____)

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL

END OF FORM

FORM AI

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENT

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Cypress-Fairbanks Independent School District

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

Cypress-Fairbanks ISD Proposal Number: 25-03-5755-R-RFP

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

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

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

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

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

_____ Notary Public in and for the state of _____.

FORM AI

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENT

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Cypress-Fairbanks Independent School District

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

Cypress-Fairbanks ISD Proposal Number: 25-03-5755-R-RFP

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

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of \$ _____
for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted) on the property of Cypress-Fairbanks Independent School District (owner) located at _____
_____ (location) to the following extent: _____ (job description).

The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

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

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

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20 ____.

_____ Notary Public in and for the state of _____.

FORM AI

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENT

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Cypress-Fairbanks Independent School District

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

Cypress-Fairbanks ISD Proposal Number: 25-03-5755-R-RFP

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

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

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

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

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

_____ Notary Public in and for the state of _____.

FORM AJ

WARRANTY CERTIFICATE

PROJECT NAME: **2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements**

Cypress-Fairbanks I.S.D. Proposal Number: **25-03-5755-R-RFP**

Architect's Project Number: 01818-08-01 to 01818-08-02, 01818-08-03, & 01818-08-04

Address: _____

OWNER NAME: *Cypress-Fairbanks Independent School District*

Phone No. (281) 897-4108

(Name of Company) Warrants _____
(Description of Work/Products/ Division Number)

against defective materials, workmanship, machinery, hardware, and equipment. The above-mentioned company agrees to repair or replace such defective items at its own expense for a period of _____ year/s from the Date of Substantial Completion.

FIRM ISSUING WARRANTY: _____ **Phone No.** _____

Address: _____ **City** _____ **State** _____ **Zip** _____

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

(Printed Name)

(Signature)

(Title)

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

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

FORM AK

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

Complete this form and return to the Architect upon close-out of the project.

PROJECT NAME: **2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller**

Replacements

Cypress-Fairbanks I.S.D. Proposal Number: **25-03-5755-R-RFP**

Architect's Project Numbers: **01818-08-01 to 01818-08-02, 01818-08-03, & 01818-08-04**

OWNER NAME: Cypress-Fairbanks Independent School District

Phone No. (281) 897-4108

Address: 11440 Matzke Rd., Cypress, Texas 77429

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

SIGNED: _____

DATE: _____

PRINTED NAME: _____

TITLE: _____

COMPANY: _____

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF _____)

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

END OF FORM

FORM AL

**CERTIFICATION
OF PROJECT
COMPLIANCE**

Distribution to:

District	☐	Architect/Engineer	☐
Contractor	☐	Texas Education Agency	☐
Other	☐	Building Department	☐

1. PROJECT INFORMATION:

2025 Campbell MS, Cy Ranch & Jersey
Village HS and Berry ESC Chiller
Replacements

ARCHITECT/ENGINEER:

Huckabee, Inc.

CONTRACTOR/CM:

PROJECT NUMBER: 25-03-5755-R-RFP

CONTRACT DATE:

DISTRICT: Cypress-Fairbanks Independent School District
11440 Matzke Rd.
Cypress, Texas 77429

DATE DISTRICT AUTHORIZES PROJECT:

BRIEF DESCRIPTION OF PROJECT: The Project consists of renovations/new _____.

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 enrollment projections, educational specifications and objectives of this facility along with the identified building code to be used have been provided to the Architect/Engineer.

DISTRICT: Cypress-Fairbanks I.S.D.

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 State Board of Education, July 1992, and as provided by the district.

ARCHITECT: Huckabee Architect

BY:

DATE:

- 5. The Contractor/CM** certifies that this project has been constructed in general conformance with the construction documents as prepared by the Architect/Engineer listed above.

CONTRACTOR:

BY:

DATE:

- 5. The District** certifies to completion of the project (as defined by the Architect/Engineer and Contractor).

DISTRICT: Cypress-Fairbanks I.S.D.

BY:

DATE:

INSTRUCTIONS FOR COMPLETION OF “CERTIFICATION OF PROJECT COMPLIANCE” FORM

Section 1. Identify the following:

- name and address of the school facility
- the Architect/Engineer and Contractor
- the school district’s project number (if applicable)
- the date of execution of the construction contract
- name, address, and telephone number of the school district
- the date that the school district authorized the superintendent to hire an Architect/Engineer
- scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the Architect/Engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.104, School Facilities Standards) and returned to the school district’s files.

Section 5. This section is to be executed by the Contractor upon substantial completion of the project and retained in the school district’s files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

END OF FORM

REQUEST FOR CLARIFICATION DURING PROPOSAL PROCESS

PROJECT: _____

CONTRACTOR: _____

SUBMITTED BY:

PRINTED NAME: _____

TITLE: _____

TELEPHONE: _____

FAX: _____

EMAIL: _____

[illegible]

END OF FORM

SECTION AN

Conflict of Interest Questionnaire

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

Each Proposer must complete the on-line version of the Conflict Of Interest Questionnaire at the following website:

<https://app.cfsd.net/ciq/index.aspx>

Full instructions for completing the Questionnaire are included at this website.

CERTIFICATION OF PROPOSER'S COMPLETION OF CONFLICT OF INTEREST QUESTIONNAIRE

The undersigned certifies that he has completed the Conflict of Interest Questionnaire per the above information.

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

Authorized Signature

Printed Name

Title

Name of Contracting Firm

Address

Telephone

Date

PROJECT CLOSE OUT – FORM AO

TO BE INITIALED BY ARCHITECT AND CONTRACTOR PRIOR TO OWNER'S FINAL CLOSEOUT REVIEW

PROJECT NAME:

NOTE: SUBMIT ALL DOCUMENTS RELATED TO SUBCONTRACTORS AND SUPPLIERS IN ALPHABETICAL ORDER BY NAME OF COMPANY UNLESS NOTED OTHERWISE

	<u>Contractor's Initials</u>	<u>Architect's Initials</u>	<u>CFISD PM Initials</u>
CFISD Close Out Log - with Subcontractors Filled Out	_____	_____	_____
List of Project Team	_____	_____	_____
List of Final Subcontractor/Suppliers/Local Representatives (Form AF)	_____	_____	_____
"Consent of Surety to Final Payment" AIA G707 ☐ 1. Check for Corporate Seal ☐ 2. Check for Original Signature ☐ 3. Check for Project Name	_____	_____	_____
"Contractor's Affidavit of Payment of Debts and Claims" AIA G706 ☐ 1. Check for Notary ☐ 2. Check for Original Signature ☐ 3. Check for Project Name	_____	_____	_____
"Contractor's Affidavit of Release of Liens" AIA G706A ☐ 1. Check for Notary ☐ 2. Check for Original Signature ☐ 3. Check for Project Name	_____	_____	_____
Subcontractors' Waiver of Lien (Subcontractors/Major Suppliers) (Conditional or Unconditional) (Form AI) ☐ 1. Check against Subcontractor List ☐ 2. Check for Notary ☐ 3. Check for Original Signature ☐ 4. Check for Project Name	_____	_____	_____
"Certificate of Substantial Completion" AIA G704	_____	_____	_____
Allowances ☐ 1. <i>CPR Execution Complete (Owner)</i> ☐ 2. <i>Account Balance Review (Owner)</i> ☐ 3. Executed Final Change Order	_____	_____	_____
Architect letter confirming all punch list items complete <i>(Architect)</i> ☐ 1. Final Signed Off Punch list	_____	_____	_____
List of All Permits during Job and a Copy of All Permits	_____	_____	_____

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD</u> <u>PM</u> <u>Initials</u>
Storm Water Quality Permit (As-Built Certificate)	_____	_____	_____
☐ 1. Check for Original Signature			
☐ 2. Check for Project Name			
☐ 3. Check for Permit Number			
☐ 4. Check for Engineer License Seal			
Utilities (Owner)	_____	_____	_____
☐ Invoice/Check for Electricity			
☐ Invoice/Check for Gas			
☐ Invoice/Check for Water/Sewer/Irrigation			
Contractor's Overtime	_____	_____	_____
☐ Invoices Sent to Contractor (Owner)			
☐ Payment Received by Contractor (Owner)			
Copy of Certificate of Compliance/Occupancy from local governmental Authorities	_____	_____	_____
Project Compliance Certificate (Owner Form AL)	_____	_____	_____
☐ 1. Check for Original Signature			
☐ 2. Check for Project Name			
Hazardous Material Certificate (Architect, General Contractor/Contractor, Subcontractors, and Material/Equipment Suppliers) Each shall be notarized. (Form AK)	_____	_____	_____
☐ 1. Check against Subcontractor List			
☐ 2. Check for Notary			
☐ 3. Check for Project Name			
☐ 4. Check for Original Signature			
Asbestos Manifest	_____	_____	_____
☐ Signed by all appropriate parties			
Report from Asbestos Consultant confirming abatement observations and air monitoring	_____	_____	_____
☐ 1. Asbestos Reports			
☐ 2. <i>Transmit Originals to Maintenance, Keep Copies for File. (Owner)</i>			
Letter from Building Envelope Consultant confirming all deficiency items complete	_____	_____	_____
Roofing Warranty & Documentation	_____	_____	_____
☐ <i>Send Copies to Director of Maintenance (Owner)</i>			
☐ Compliance letter on Roofing from Roofing Consultant			
☐ Roofing Manufacturer Letter confirming Warranty			
☐ Copy to Roof Warranty Binder (Owner)			
☐ Place Original in Roof Warranties Binder (Owner)			
TDLR Inspection	_____	_____	_____
☐ Inspection Report			
☐ Deficiencies documented and corrected (if applicable)			
☐ Approval letter from TDLR			

CFISD
PM
Initials

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD</u> <u>PM</u> <u>Initials</u>
All Extra Stock Transmittals by Division	_____	_____	_____
CFISD Master Keys Returned	_____	_____	_____
Paint Mix Cards	_____	_____	_____
List of Finishes used in Project	_____	_____	_____
Demonstration and Training Sign In Sheets by Division with Digital Video if applicable	_____	_____	_____
Maintenance/Operations Manuals (2 hard copies, 1 digital copy) (Reviewed/Approved by Architect)	_____	_____	_____
☐ Divisions 0 – 21			
☐ Division 22 Plumbing			
☐ Division 23 HVAC			
☐ Division 26 Electrical			
☐ Division 27, 28 and beyond as applicable			
Record Drawings / As-Built	_____	_____	_____
☐ 1. Record CAD Files			
☐ 2. Record PDF Files			

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the close out documentation attached has been accurately completed in accordance with the Contract Documents, and requests permission to submit the FINAL Application and Certification for Payment AIA G702 Document for the outstanding retainage owed under the contract.

Contractor:

By: _____

Print Name: _____

In accordance with the Contract Documents, based on data comprising the attached, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Project Close Out Documents have been completed as indicated, the accuracy of the documents is in accordance with the Contract Documents.

Architect:

By: _____

Print Name: _____

CFISD Project Manager Signature: _____

Date: _____

CFISD Director of Project Management Signature: _____

Date: _____

CFISD Director of Contract Management Signature: _____

Date: _____

CFISD Assistant Superintendent Signature: _____

Date: _____

FORM AP – Contractor

SB 9 Public Works Contractor Certification

Introduction: Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors must certify to the District that they have complied.

The District may not obtain criminal histories for contractors: The law requires each contractor to obtain the criminal histories of its covered employees.

Definitions:

Covered employees: Employees of a contractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. **Disqualifying criminal history:** (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

On behalf of _____ ("Contractor"), I, the undersigned authorized signatory for Contractor, certify to Cypress-Fairbanks Independent School District ("District") and Contractor that [check one]:

☐ None of Contractor's employees are *covered employees*, as defined above. If this box is checked, I further certify that Contractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Contractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

☐ Some or all of Contractor's employees are *covered employees*. If this box is checked, I further certify that:

- 1) Contractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Contractor receives information that a covered employee subsequently has a reported criminal history, Contractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Contractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District on behalf of Contractor that Contractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

Signature

Date

Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: contractor_badges@cfisd.net

Notes

Public works contractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works contractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
 - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
 - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.

FORM AP - Subcontractor SB 9 Public Works Contractor Certification

Introduction: Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Subcontractors must certify to the District and to the contractor that they have complied.

The District may not obtain criminal histories for subcontractors: The law requires each subcontractor to obtain the criminal histories of its covered employees.

Definitions:

Covered employees: Employees of a subcontractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. **Disqualifying criminal history:** (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

Subcontractor has entered a contract with _____ ("Contractor") to provide services in connection with contract between Cypress-Fairbanks Independent School District ("District") and Contractor. On behalf of _____ ("Subcontractor"), I, the undersigned authorized signatory for Subcontractor, certify to the District and Contractor that [check one]:

☐ None of Subcontractor's employees are *covered employees*, as defined above. If this box is checked, I further certify that Subcontractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Subcontractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

☐ Some or all of Subcontractor's employees are *covered employees*. If this box is checked, I further certify that:

- 1) Subcontractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Subcontractor receives information that a covered employee subsequently has a reported criminal history, Subcontractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Subcontractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Subcontractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District and Contractor on behalf of Subcontractor that Subcontractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

Signature

Date

Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: contractor_badges@cfisd.net

Notes

Public work subcontractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works subcontractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
 - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
 - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.



Cypress-Fairbanks Independent School District

Employee List Form

FORM AP - CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION

For Contractors, Sub-Contractors, Service Providers, & Vendors

Project Name: _____

Date: _____

Project Number: _____

CFISD Project Manager: _____

Company Name: _____

Mailing Address: _____

Phone: _____

PLEASE TYPE OR PRINT CLEARLY

[illegible]

FACILITIES PLANNING AND CONSTRUCTION

CERTIFICATE OF FINAL COMPLETION (AQ)

Project Name:	2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements	Project No.:	25-03-5755-R-RFP
Contractor:			
Contract No.:	01818-08-01 to 01818-08-04	Contract Date:	
Architect/Engineer:	Huckabee Architects		
Date of Final Completion:		Time of Final Completion (include Time Zone CT):	

DATE OF FINAL COMPLETION

The work performed under this contract has been inspected and found to be complete. This constitutes the Owner's acceptance for final completion for the **ENTIRE** contract amount. The date of final completion of the project is hereby established as set forth above.

In accordance with the General Conditions and Supplementary Conditions of the contract, this is to confirm the results of the final completion inspection(s). The Contractor has completed the list of items identified on the pre-final and final punch list(s) that the inspection team required corrected or completed before final acceptance of the work in accordance with the contract. Work accepted with incomplete punch list items or failure of the Owner or other parties to identify work that does not comply with the contract documents or is defective in operation or workmanship does not constitute a waiver of the Owner's rights under the contract or relieve the Contractor of its responsibility for performance or warranties.

In accordance with the contract, the date of final completion is that date jointly certified by the Contractor, Architect/Engineer and Owner that the work is completed and the contract is fully satisfied according the contract documents. Completion of all work is a condition precedent to the Contractor's right to receive final payment.

The **CONTRACTOR** has completed/corrected the items identified on all referenced punch list(s) and the requirements of the contract are fully satisfied according to the contract documents.

<i>Project Manager</i>	<i>(Print Name)</i>	<i>(Date)</i>

The **ARCHITECT** agrees that the work noted in this Certificate of Final Completion is completed in accordance with the contract documents.

<i>Project Architect</i>	<i>(Print Name)</i>	<i>(Date)</i>

The **OWNER** accepts the work designated herein to be in accordance with the requirements for final completion, except as provided in the contract documents.

<i>Project Manager</i>	<i>(Print Name)</i>	<i>(Date)</i>

<i>Director of Construction Field Services</i>	<i>(Print Name)</i>	<i>(Date)</i>

<i>Director of Project Management</i>	<i>(Print Name)</i>	<i>(Date)</i>

<i>Director of Contract Management</i>	<i>(Print Name)</i>	<i>(Date)</i>

<i>Assistant Supt. of Facilities & Construction</i>	<i>(Print Name)</i>	<i>(Date)</i>

<i>Chief Operations Officer</i>	<i>(Print Name)</i>	<i>(Date)</i>
<i>Associate Supt. of Facilities, Construction &</i>		



FACILITIES PLANNING AND CONSTRUCTION

Support Services

SECTION AR

DISCLOSURE OF INTERESTED PARTIES

Section 2252.908 of the Texas Government Code requires a business entity that enters into a contract with a school district must submit a disclosure of interested parties (Form 1295) to the school district and state agency and applies to contracts with a value of \$1,000,000.00 or greater and applies to all contracts entered into on or after January 01, 2016.

An example of the Form 1295 is included in this section; however the form shall be required to be filled out online, printed and signed, and submitted with the contract of which it is applicable.

Filing Process:

By January 01, 2016, the Texas Ethics Commission will make available on its website a new filing application that must be used to file Form 1295. A business entity must use the application to enter the required information on Form 1295 and print a copy of the form and a separate certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 and certification of filing must be filed with the governmental body or state agency with which the business entity is entering into the contract.

The governmental entity or state agency must notify the commission, using the commission's filing application, of the receipt of the filed Form 1295 and certification of filing not later than the 30th day after the date the contract binds all parties to the contract. The commission will post the completed Form 1295 to its website within seven business days after receiving notice from the governmental entity or state agency.

Information regarding how to use the filing application will be available on the Texas Ethics Commissions site by January 01, 2016 at www.ethics.state.tx.us.

CERTIFICATE OF INTERESTED PARTIES			FORM 1295	
Complete Nos. 1 - 4 and 6 if there are interested parties. Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.			OFFICE USE ONLY	
1 Name of business entity filing form, and the city, state and country of the business entity's place of business.			Must file online at www.ethics.state.tx.us/File	
2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.				
3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.				
4	Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
			☐ Controlling	☐ Intermediary
5 Check only if there is NO Interested Party. ☐				
6 UNSWORN DECLARATION My name is _____, and my date of birth is _____. My address: _____ (street) _____ (city) _____ (state) _____ (zip code) _____ (country). I declare under penalty of perjury that the foregoing is true and correct. Executed in _____ County, State of _____, on the _____ day of _____, 20_____. (month) (year) _____ Signature of authorized agent of contracting business entity (Declarant)				
ADD ADDITIONAL PAGES AS NECESSARY				

DOCUMENT BA

CONTRACT DOCUMENTS

I. CONSTRUCTION CONTRACT AGREEMENT

- A. The contract for the construction of the project shall be executed by the successful Offeror on the AIA Document A101™-2017, as amended "Standard Form of Agreement between Owner and Contractor." A Notice to Proceed shall be issued 10 days following Board Award.
- B. A sample of this AIA Document A101™-2017, as amended is attached here within.

II. CONDITIONS OF THE CONTRACT

- A. General Conditions:
 - 1. The General Conditions of the Contract for Construction AIA Document A201™-2017, as supplemented and amended herein, constitutes the General Conditions and is hereby specifically made part of the Contract Documents.
- B. Supplementary Conditions:
 - 1. For modifications to the General Conditions of the Contract for Construction AIA Document A201™-2017, as amended refer to Section CB for the Supplementary Conditions.

END OF DOCUMENT

DRAFT 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 [DAY]TH day of [MONTH] in the year 2025
(In words, indicate day, month and year.)

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

Cypress-Fairbanks Independent School District
11430-B Perry Road
Houston, Texas 77064
Telephone: 281-897-4057
Fax: 281-897-3806

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

« (TBD) »
« »
« Telephone: »

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

PROJECT NAME
CFISD Project Number: XX-XX-XXXXR-RFP
Architect Project No. XXXX

ADDRESS

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

ARCHITECT INFO

The Owner and Contractor agree as follows.

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.

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.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS
10	INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), all sections of the Project Manual and Construction Documents, Drawings, Specifications, Addenda issued prior to execution of this Agreement, the Contractor's proposal and written amendments or addenda to the proposal, the Contractor's bonds and proof of insurance, other documents listed in this Agreement, Modifications issued after execution of this Agreement, and attached exhibits; these 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.

"Construction Documents" means: all drawings, specifications, submittals, transmittals, deliverables, instructions to Contractors, and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants and which set forth in detail the requirements for construction of the Project.

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.

☒ [« X »] A date set forth in a notice to proceed issued by the Owner. The Contractor may not commence construction, however, until all bonds and insurance required by the Contract Documents have been received by the Owner. All bonds and insurance will be reviewed and approved by the Owner for compliance with the Contract Documents prior to the Contractor mobilizing onsite. Upon Owner approval, the Contractor will be allowed to mobilize onsite.

☐ [« »] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

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.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than the date(s) listed below:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work	Substantial Completion Date
Entire Scope of Work	[REFER TO SUMMARY OF WORK]

subject to adjustments of the Contract Time as provided in the Contract Documents.

(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

Contractor shall achieve buy out of all subcontracts and trades within thirty (30) days following Notice to Proceed.

Contractor shall provide complete Schedule of Values within thirty (30) days following Notice to Proceed.

Liquidated Damages: Refer to AIA Document A201™–2017, General Conditions of the Contract for Construction as amended, Article 8.4.

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 XXXX Dollars (\$0.00), subject to additions and deductions as provided in the Contract Documents.

§ 4.1.1 The Contract Sum contains an Owner's Betterment Allowance in the amount of XXXX Dollars (\$0.00). This allowance is for the sole use of the Owner to be used for changes in the scope of the Work and for the betterment of the Project. Owner's authorized representative may approve any expenditure from Owner's Betterment Allowance without further Board of Trustees approval. If the Owner's Betterment Allowance is not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating final payment.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

Base Proposal in the amount of	\$0.00

Total Contract Sum.....	\$0.00

Refer to Exhibit A (includes Base Proposal, Alternate Proposal(s) and Unit Price(s).)

§ 4.3 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)

Refer to Exhibit A, Form AC – Competitive Sealed Proposal Form, Base Proposal and Alternate Proposal

§ 4.4 Allowances included in the Contract Sum, if any:

(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Allowance Amount
Owner's Betterment Allowance	[REFER TO ALLOWANCE]

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 at equal one-month intervals. No more than one (1) Application for Payment may be submitted within a given calendar month and shall be submitted to the Owner as required in AIA Document A201™-2017, as amended Article 9.3.6.

§ 5.1.3 The Owner shall make payment of the undisputed, certified amount to the Contractor not later than thirty (30) days after Owner received the Application for Payment, that has been certified by the Architect. If errors are discovered by the Owner in the certified Application for Payment, the Owner shall reject the Application for Payment and return it to the Contractor for correction. The specified time period for payment of such Application for Payment will start over on the date the Owner receives the corrected Application for Payment that has been re-certified by the Architect.

§ 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, unless objected to by the Architect and Owner, 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 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5.0%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.8 of AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended;
- .2 Add 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), less retainage of five percent (5.0%);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201™-2017, as amended.

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

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201™-2017, as amended.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

«The full applicable five percent (5.0%) retainage will be held until Final Completion of the Work associated with the Contract has been achieved. »

§ 5.1.9 Except with the Owner's prior approval, 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, shall be made by the Owner to the Contractor when:

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2 of AIA Document A201–2017, as amended, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.
- .3 all project close-out documents in their entirety have been completed, submitted to and approved by the Owner.

§ 5.2.2 Upon verification and approval by the Architect and Owner that all Contract requirements have been completed in their entirety, the Contractor shall submit the final Application for Payment to the Architect for approval and certification. Upon receipt of such final Certificate for Payment, the Owner's final payment to the Contractor shall be made no later than thirty (30) days after the issuance of the Architect's final Certificate for Payment, or as follows:

If the Contractor submits the Final Application for Payment to the Architect prior to the verification and approval by the Architect and Owner that the Contractor has completed all Contract requirements, the Architect will return the Application for Final Payment to the Contractor as NOT APPROVED. If errors are discovered by the Owner in the certified Final Application for Payment, the Owner shall reject the Final Application for Payment and return it to the Contractor for correction. The specified time period for payment of such final Application for Payment will start over on the date the Owner receives the corrected final Application for Payment that has been certified by the Architect. Refer to AIA Document A201™–2017, Article 9 as amended.

§ 5.2.3 At the end of the project, after all work is completed according to the Contract Documents, including all closeout documents, the Owner shall release all retainage to the subcontractors, sub-subcontractors and vendors. The retainage for the General Contractor, including, but not limited to, all work self-performed by the General Contractor; and all general condition line items, shall be held until all lien releases have been provided to and accepted by the Owner.

The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment.

§ 5.3 Interest

Payments due and unpaid under the Contract for undisputed amounts shall bear interest pursuant to Texas Prompt Payment Act.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Refer to AIA Document A201–2017, Article 4 as amended. For any Claim or dispute not resolved by the process in Article 4 of AIA Document A201-2017, as amended, the method of binding dispute resolution shall be 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.

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

§ 8.2 The Agreement shall be governed by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue shall be in Harris County, Texas.

§ 8.3 As a material consideration of the making of this Agreement, the modifications to this Agreement shall not be construed against the maker of said modifications.

§ 8.4 Notwithstanding anything to the contrary in this Agreement, or in any document forming a part hereof, there shall be no mandatory arbitration for any dispute arising hereunder.

§ 8.5 The Contractor may not assign its responsibilities, duties, obligations, and rights under this Agreement, without the express written consent of the Owner. This does not prevent Contractor from engaging subcontractors to perform various phases of the Project, but Contractor shall be fully responsible to Owner for the Work, actions, and omissions of all such subcontractors.

§ 8.6 This Agreement, in its entirety, shall be binding upon all the parties hereto, their respective successor, heirs, executors, administrators, or assigns.

§ 8.7 Execution of this Agreement shall constitute approval and acceptance of all terms, covenants, and conditions as modified and contained in the Contract Documents.

§ 8.8 This Agreement is subject to all applicable federal and state laws, rules, and regulations. Invalidity of any portion of this Agreement under the law of the State of Texas or of the United States shall not affect the validity of the remainder of this Agreement.

§ 8.9 Contractor stipulates that Owner is a political subdivision of the State of Texas, and, as such, enjoys immunities from suit and liability as provided by the constitution and laws of the State of Texas. By entering into this Agreement, Owner does not waive any of its immunities from suit and/or liability, except as otherwise specifically provided herein, and as specifically authorized by law.

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

Matthew Morgan
Chief Operations Officer/Associate Superintendent
Facilities, Construction & Support Services
Cypress-Fairbanks Independent School District
11440 Matzke Road
Cypress, Texas 77429
Telephone: 281-517-2809
Fax: 281-517-2114

Jesse Clayburn
Assistant Superintendent of Facilities and Construction
Cypress-Fairbanks Independent School District
11440 Matzke Road
Cypress, Texas 77429
Telephone: 281-897-4057
Fax: 281-897-3806

PROJECT MANAGER
Project Manager
Cypress-Fairbanks Independent School District
11430 Perry Road
Houston, Texas 77064
Telephone: 281-XXX-XXXX
Fax: 281-897-3806

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

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§ 8.12 Neither the Owner's nor the Contractor's representative shall be changed without ten (10) days written notice to the other party.

§ 8.13 Other Provisions

§ 8.13.1 All terms "Bidders" and "Bids" are modified to "Proposers" and "Proposals".

§ 8.13.2 Contractor and each subcontractor and sub-subcontractor assigning hereby assigns to Owner any and all claims for overages associated with this Contract which arises under the Antitrust laws of the United States, 15 U.S.C.A. Section 1, et.seq (1973).

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2017, Standard Form of Agreement Between Owner and Contractor, as amended.

§ 9.1.2 The General Conditions are AIA Document A201–2017, General Conditions of the Contract for Construction as amended.

Document	Title	Date	Pages
Section CA Section CB	Application for Payment Checklist Supplementary Conditions to the General Conditions of the Contract for Construction as Amended		
Section CC	Right to Audit		

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Exhibit A	Forms AC, AE, AF, AG, AH, AN and Resumes		
Document	Title	Date	Pages
Exhibit B	Front End Documents Table of Contents		

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages
Exhibit C	Specifications Table of Contents		

§ 9.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages
Exhibit D	Index of Drawings		

§ 9.1.6 The Addenda, if any:

Number	Date	Pages
Addendum No. 1		

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

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

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, as amended provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

Section	Title	Date	Pages
Exhibit E	Section 01 35 23 Special Owner Requirements		
Exhibit F	Post Proposal Addendum No. X (If Applicable)		

ARTICLE 10 INSURANCE AND BONDS

§ 10.1 The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2017, as amended and Section BD of the project specifications.

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

OWNER (Signature)

«Scott Henry, President of the Board of Trustees or
Administrative Designee
«Administrative Designee:
Mr. Matthew Morgan,
Chief Operations Officer/Associate Superintendent
of Facilities, Construction & Support Services »

(Printed name and title)

CONTRACTOR (Signature)

« »
« »
« »
« »
« »
« »

(Printed name and title)

DRAFT AIA® Document A201® - 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements

CFISD Project Number: 25-03-5755-R-RFP

Architect Project No. 01818-08-01, 01818-08-02, 01818-08-03, 01818-08-04

CAMPUS ADDRESS:

Campbell MS – 11415 Bobcat Rd., Houston 77064

Cy Ranch HS – 10700 Fry Rd., Cypress 77433

Jersey Village HS – 7600 Solomon St., Houston 77040

Berry ESC – 8877 Barker Cypress Rd., Cypress 77433

THE OWNER:

(Name, legal status and address)

-Cypress-Fairbanks Independent School District

11430-B Perry Road

Houston, Texas 77064

Telephone Number: 281-897-4108

Fax Number: 281-897-3806-»«-»

THE ARCHITECT:

(Name, legal status and address)

Huckabee, Inc

1700 City Plaza Dr. City Place 1, Suite 125

Spring, TX 77389

Texas IBI Group, Inc.

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ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

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

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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 as amended (hereinafter the Agreement) and consist of the Agreement, Conditions of the ~~Contract (General, Supplementary and other Conditions)~~, Drawings, Specifications, Contract, as amended (General, Supplementary and other Conditions), Performance Bond, Labor and Materials Payment Bond and Proof of Insurance, Contractor's Proposal, Drawings, Specifications, all Addenda issued prior to execution of the Contract, other documents listed in the Agreement, 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, Directive or a Change Proposal Request~~, 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~~ This agreement, as amended, represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Construction Documents become part of the Contract when accepted by the Owner. All sections of the Project Manual shall be a part of the Contract, including any Proposal signed by the Contractor, and any Request for Proposals for the Project ("RFP"). ~~The Contract~~ may be amended or modified only by a ~~Modification-written Modification signed by the Owner.~~ 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.

It also includes all supplies, skill, supervision, transportation services, storage requirements 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.

§ 1.1.4 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.

§ 1.1.7 The Project Manual

The Project Manual is a volume assembled for the Work which may include the bidding or proposal requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.1.8 Addenda

Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Proposal Documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction agreement is executed. The successful Contractor and his Subcontractors shall post all addendum items on their sets of Drawings and Specifications.

§ 1.1.9 Approved Equal, Approved Equivalent or Equal

The terms Approved and Approved Equivalent relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.19 Substitution of Products and Systems for procedure which must be followed.

§ 1.1.10 Proposal Documents

Proposal Documents consist of all documents bound into or referenced in the Project Manual, the Drawings, and Addenda related thereto. The Project Manual contains the Proposal Requirements, Sample Forms, Conditions of the Contract, the Specifications, and a list of Drawings, and Schedules, some of which are bound into the Project Manual (Other Drawings and Schedules are bound separately).

§ 1.1.11 Miscellaneous Other Words

The terms "Bids" or "Bidding" mean Competitive Sealed Proposal, which by definition allows the Owner to accept the "best value" for the school district, based on factors other than cost.

§ 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.

§ 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.

§ 1.2.4 Precedence of the Contract Documents

The most recent issued Document takes precedence over the previous issued forms of the same Document. The order of precedence is as follows with the highest authority listed first.

- .1 The Agreement
- .2 The Addenda

.3 Conditions of the Contract, Drawings and Specifications shall have equal authority. Should these documents disagree in themselves, the Architect will select the appropriate method for performing the work at no additional increase in the Contract Cost.

In the case of an inconsistency between the Drawings and Specifications or within either set of Documents discovered prior to Proposal Time but too late to be clarified by an Addendum, the better quality or greater quantity of work shall be included in the proposal. Clarification of the inconsistency will be accomplished with Contractor after award of the Contract, and if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

§ 1.2.5 Relation of Specifications and Drawings

The Drawings and Specifications are correlative and have equal authority and priority. Should they disagree in themselves, or with each other, base the proposals on the most expensive combination of quality or quantity of work indicated. The appropriate method of performing the Work, in the event of the above-mentioned disagreements, will be made by the Architect.

§ 1.2.6 Optional Materials, Brands and Processes

When more than one is specified for a particular item of Work, the choice shall be the Contractor's. The final selection of color and pattern will be made by the Architect from the range available within the option selected by the Contractor, unless the item is specified to match a specific color or sample furnished. Where particular items are specified only products of those named manufacturers are acceptable. Certain specified construction and equipment details may not be regularly included as part of the named manufacturer's standard catalog equipment but shall be provided by the manufacturer as required for the proper functioning of the equipment. Reasonable minor variations in equipment are expected and will be acceptable; however, indicated and specified performance and material requirements are minimum, and will be required in addition to standard accessories. The Architect reserves the right to determine the equality of equipment and materials that deviate from any of the indicated and specified requirements.

§ 1.2.7 Standards and Requirements

When the Contract Documents refer to standards, building codes, manufacturers' instructions, or other documents, unless otherwise specified, then the current edition as of the date of execution of the Agreement by the last party to execute said Agreement shall apply. It shall be the responsibility of the Architect to address revisions or amendments to applicable codes or standards which arise after the date of execution of the Agreement and until Final Completion, pursuant to the terms of the Agreement between Owner and Architect. Requirements of public authorities apply as minimum requirements only and do not supersede more stringent specified requirements.

§ 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~~ 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 **Execution of Contract Documents**

§ 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.~~ Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 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.~~ 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 to the Contract Documents. If an approved Contact Document requiring Contractor's signature has not been signed, then the missing signature shall be provided within a reasonable period of time. Failure of Contractor to sign an approved Contract Document after notice and a reasonable opportunity to sign, shall be considered a material breach of the Contract by Contractor.

§ 1.6 Notice

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

§ 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. The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Construction Documents through which the Work to be executed by the Contractor is described. All ownership rights, whether common law, statutory, or other reserved rights, including copyright ownership of the Construction Documents, are controlled by the Agreement between the Owner and Architect. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of any copyrights or other reserved rights.

§ 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 protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 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 protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, Project Building Information Modeling Protocol Form, 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.

§ 1.7 Miscellaneous Other Definitions

§ 1.7.1 Alternate Proposal(s)

A separate amount stated on the 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 a period of 120 days after receipt of proposals, unless otherwise modified, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

§ 1.7.2 Base Proposal

The Contractor's proposal for the Work, not including any Alternates.

§ 1.7.3 Contract Time

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is not subject to adjustment or extension without the written permission of the Owner.

§ 1.7.4 Date of Agreement

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted on the first page of the Agreement Between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of the Work.

§ 1.7.5 Date of Commencement of the Work

The commencement date shall be the date the contract award is approved by the CFISD Board of Trustees. This date constitutes day zero ("0") of Contract Time.

§ 1.7.6 Date of Final Completion

The end of construction. Refer to Section 9.10.

§ 1.7.7 Day

The following days are referenced in the documents:

- .1 Calendar Days: The days of the Gregorian Calendar. The Contract Time is established in Calendar Days and extensions of time granted for Regular Work Days lost, in excess of anticipated delay day allowance, will be converted to Calendar Days.
- .2 Holidays: The days officially recognized by the construction industry and/or Owner approved holidays, in this area as a holiday; normally limited to the observance days of New Year's Day, Martin Luther King, Jr. Day, Good Friday, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the Friday after, Christmas Eve, Christmas Day and New Year's Eve day.
- .3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested, after expenditure of the Anticipated Delay Day Allowance, 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). The Contractor is advised to refer to Section 01 35 23.1, Special Owner Requirements regarding after hours use of the premises.
- .4 Anticipated Delay Days Allowance: An allowance of Fifteen (15) Regular Work Days per year (or two (2) regular work days per month, whichever is less) is established as probable days lost due to delays beyond the Contractor's control. This allowance includes District testing dates and any other days the district directs the contractor to not perform work due to unspecified campus events. This additional Delay day allowance does not include anticipated weather days as indicated in section 8.3., also does not include Holidays as indicated in Section 1.7.7.2. These days for weather and holidays are to be added to this additional delay day allowance and are to be calculated in accordance with their respective section as indicated elsewhere in these general conditions to establish the grand total of the anticipated delay day allowance.
- .5 Evaluation of Delay Days: The Architect and Owner will evaluate delays claimed by the Contractor based on the Critical Path of the Contractor's construction schedule, and if the Architect is in agreement that a Critical Path task has been delayed due to circumstances beyond the Contractor's control, the accepted delay days will be deducted from the Anticipated Delay Day Allowance.
- .6 Delay Days: Regular Work Days when circumstances beyond the Contractor's control prevent progress on major portions of the Work as described in Paragraph 8.3, Delays and Extensions of Time, in the General Conditions of the Contract for Construction.

§ 1.7.8 Notice to Proceed

A notice that may be given on behalf of the Owner to the Contractor, through the Architect, that directs the Contractor to start the Work. It also establishes the Date of Commencement of the Work.

§ 1.7.9 Provide

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install."

§ 1.7.10 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. Refer to Article 9.8.

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, independent school district identified in the Contract Documents. The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to: enter into a contract; amend a contract; approve changes in the scope of the Work; approve and execute a Change Order or Construction Change Directive modifying the Contract Sum; agree to an extension to the date of Substantial or Final Completion; or terminate a contract. The Board designates authorized representatives to act on its behalf for day-to-day operations under the Contract. Unless otherwise designated in the Contract Documents, Owner's authorized representative shall be the Superintendent of Schools, who may delegate responsibilities as appropriate. Owner's Board of Trustees hereby delegates to the Superintendent of Schools or designee the authority to approve changes to the Work where such changes are within the Owner's Betterment Allowance or other designated Allowances stipulated in the Contract Documents and also the authority to approve any Change Order which does not exceed \$249,999.99 and the authority to approve any and all time extensions to the Contract. Any Change Order that is valued at or above \$250,000 shall require Board approval in accordance with Local Board Policy. Except as otherwise provided in the Contract Documents, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative. Neither Architect nor Contractor may rely upon the direction of any employee of Owner who has not been designated in writing in the Contract Documents. Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

§ 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. It shall be distinctly understood that by virtue of this Contract, neither the Contractor nor any contractor, subcontractor, sub-subcontractor, consultant, design professional, mechanic, material person, artisan, or laborer, skilled or unskilled, shall ever in any manner have, claim, or acquire any lien upon the buildings or any of the improvements of whatsoever nature or kind so erected or to be erected by virtue of this Contract or upon any of the land on which said buildings or any of the improvements are so erected, built, or situated. It shall be further understood that this Contract is not written for the benefit of third parties nor shall it be construed to create any third party beneficiaries.

§ 2.2 Evidence of the Owner's Financial Arrangements Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor Work, the Contractor may request in writing that the Owner provide 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. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 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. 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.

§ 2.2.3 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. 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 reasonably rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work, shall exercise due diligence in attempting to located underground utilities, and shall notify the Owner and Architect of any discrepancies between the surveys and actual conditions of the site that Contractor observes or should observe in the exercise of ordinary care.

§ 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. 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.

§ 2.2.5 Refer to Section CB, Supplementary Conditions, for quantities of plans and project specifications to be furnished to the Contractor.

§ 2.3 Information and Services Required of the Owner**Owner's Right to Stop the Work**

§ 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.

§ 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.

§ 2.3.1 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.

§ 2.4 Owner's Right to Carry Out the Work

§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven (7) Calendar Days 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, immediately correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor 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. Such action by the Owner and amounts charged to the Contractor are both subject to 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.

§ 2.5 Owner's Right to Occupy the Project

§ 2.5.1 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 have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents and Contractor shall be responsible for insurance, utilities and security until Substantial Completion of the entire project.

§ 2.5.2 Refer to Article 11 - Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

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.~~Documents in a good and workmanlike manner and in an expeditious and economical manner consistent with the interest of the Owner; shall exercise the degree of care, skill, and diligence in the performance of the Work in accordance with and consistent with industry standards for similar projects; shall utilize its best skill, effort, and judgment in diligently performing the Work; and shall furnish efficient business administration and supervision. Workmanship shall be of a quality to produce satisfactory results.

§ 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.~~The Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda, Modifications, and information provided by the Owner and shall at once report to the Architect any error, inconsistency, or omission he may discover. Contractor shall be liable for any damage to Owner for failure to report any error, inconsistency or omission he may discover or should have discovered, but he shall not be liable to Owner or Architect for any damage resulting for such error, inconsistency or omission which he did discover and at once so reported. Contractor shall not perform any work without approved Drawings and Specifications issued by the Architect.

§ 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 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. If any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but 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, professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.~~

§ 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. If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Sections 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Sections 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Sections 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from~~

errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

§ 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

§ 3.2.4 The Contractor shall take field measurements and verify field conditions and shall carefully compare such fields measurements and conditions and other information known to the Contractor with the Contract documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

§ 3.2.5 The Contractor shall not be entitled to additional compensation for the "rework portion" of any additional work caused by his failure to carefully study and compare the contract documents prior to execution of the Work.

§ 3.2.6 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 complies with the Contract Documents. The Contractor shall arrange meetings prior to commencement of the work of all major subcontractors to allow the subcontractor to demonstrate his understanding of the documents to the Architect/Owner and to allow the subcontractor to ask for any interpretation he may require.

§ 3.2.7 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 above requirements before additional services are performed.

§ 3.2.8 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 substitution of materials, shall be accomplished by appropriate Modification.

§ 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, sequences and procedures and for coordinating all portions of the Work under the Contract. Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences, 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, written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. 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 Contractor shall not be responsible for any resulting loss or damage arising solely from those Owner-required 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.

§ 3.3.3.1 The Contractor is especially cautioned to coordinate the routing of all mechanical, plumbing and electrical items and provide coordinating drawings in accordance with provisions of the Contract Documents prior to commencing these operations.

§ 3.3.4 Contractor shall document existing facility conditions and systems onsite prior to performing any work with video recording and/or photographs and shall test said systems to identify any pre-existing deficiencies in the presence of the Owner, Architect/Engineer. Any items not noted or identified in this documentation or brought the attention of the Owner in writing will be assumed to be in working order and any problems with such systems will be the responsibility of the Contractor to correct and repair to the pre-contract condition or better.

§ 3.3.5 Prior to performing any work, the Contractor shall locate all utility lines as shown on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, and electrical lines, and shall perform the Work in such a manner as to avoid damaging any such lines, cables, pipes and pipelines. In addition, the Contractor shall independently determine the location of same.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, eligible to work in accordance with state and federal law. In addition, unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for 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-authorized by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the prior written consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive-Change Order, Construction Change Directive, or Change Proposal Request.

§ 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.

§ 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.

§ 3.5.1 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. The Contractor is solely responsible for, and shall provide written proof of maintenance, service, and protection of materials and equipment installed prior to Substantial Completion.

§ 3.5.2 In the event of failure of materials, products, or workmanship, either during construction or the warranty period (as specified in Section 3.5.5), the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect. Items of work first performed after Substantial Completion shall have their warranties extended by the period of time between Substantial Completion and the actual performance of the Work. Such warranties shall be submitted to owner in writing, documenting such time extensions. This warranty period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the work.

§ 3.5.3 Contractor shall establish a spreadsheet-type Warranty Work tracking format included in the Project Manual and shall verify and certify completion of each warranty work item.

§ 3.5.4 Approximately six (6) and eleven (11) months after Substantial Completion, the Contractor shall accompany the Owner and Architect on a complete re-inspection of the Project and be responsible for correcting any additional deficiencies observed or reported, including any uncompleted Punch List Items or outstanding or incomplete Warranty Items.

§ 3.5.5 The Warranty Period for this Project is One (1) Year from the date of Substantial Completion except for any extended warranties as specified herewith in the Contract Documents

§ 3.5.6 The warranty period shall extend one (1) year on specific items of work (materials and labor) if warranty work is performed on a specific item or work that requires the issuance of a second warranty work request within ninety (90) days after the original warranty work request was issued.

§ 3.5.7 Warranty work shall be performed within ten (10) working days after the Contractor receives a request for warranty work, except where immediate responses are required as described below:

1. For work which is identified as affecting life safety, fire alarm or security of the occupants and/or the facility on the warranty request, on-site corrective work shall begin immediately after receipt of the warranty work request by the Contractor, 365 days per year, twenty-four (24) hours per day.
2. For work affecting the operation of the HVAC system, domestic water heaters, elevators and food service equipment (except walk-in refrigeration and/or freezer equipment), on-site corrective work shall begin within six (6) hours of Contractor's receipt of warranty work, 365 days per year 24 hours per day.
3. For walk-in refrigeration and/or freezer equipment, on-site corrective work shall begin within four (4) hours of Contractor's receipt of warranty work, 365 days per year, 24 hours per day.

§ 3.5.8 For warranty work requiring immediate response as described in 3.5.7 above, the Contractor shall maintain or contract for an answering service available 365 days per year, 24 hours per day.

§ 3.5.9 Warranty work shall be completed within six (6) hours after the initiation of on-site corrective work unless additional time is reasonably required, and the Owner has agreed on the additional time frame deemed necessary by the Contractor.

§ 3.5.10 The Owner reserves the right to complete any warranty work that Contractor fails to complete in the specified time period. Owner will backcharge Contractor for the cost of such work, including Consultants' fees.

§ 3.6 Taxes

§ 3.6.1 The Owner is exempt from the Texas Sales Tax on any purchase of tangible personal property and utilities and will issue Certificates of Exemption from the Texas Sales Tax on materials furnished by Contractors on School Construction projects. The Contractor shall give a written statement to the Owner (with a copy to the Architect) as to the proration of costs of skilled crafts, labor and materials for the project prior to awarding of a Construction Contract. The Contractors shall obtain Certificates of Resale from their suppliers in order to avoid payment of the State Sales Tax on materials incorporated in School jobs. Failure of the Contractor to obtain Certificates of Resale from their suppliers shall make the Contractor responsible for absorbing the tax.

§ 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.

§ 3.7.1.1 The Owner will pay directly or to the governing authority directly from the Allowance, the cost of all permanent connection charges, including water and sewer tap charges and the provision and installation of the irrigation meter and the domestic water meter and vault. The Owner will pay directly to the governing authority the cost of all non-taxable entity fees, capacity charges, drainage impact fees and permanent utility account deposits.

§ 3.7.1.2 The Contractor shall pay directly all temporary utility connection charges, including utility district/company inspection, survey, and permit fees for both temporary and permanent connections.

§ 3.7.1.3 The Contractor shall include in the Base Proposal, the cost for providing all backflow preventers, fire sprinkler system backflow preventers, meters, vaults, valves, taps, and piping from taps for domestic water, irrigation, and fire sprinkler systems.

§ 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~~ It is neither the Contractor's responsibility nor the Owner's responsibility to ascertain that the Contract Documents are in accordance with 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 regulations. However, if the Contractor observes or should have observed, that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification.

§ 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.~~

§ 3.7.4 If the Contractor performs Work which he knew or should have known it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.8 Allowances

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

These stated allowances represent the cost estimate of the materials and equipment delivered and unloaded at the site. The Contractor's supervision, handling costs, estimating costs, miscellaneous fees, overhead, profit, clean-up, as-builts, warranty, and other expenses contemplated for the allowance material and equipment shall be included in allowances only where called for in the various sections of these specifications.

The Contractor shall purchase the allowance materials and equipment as directed by the Architect, upon approval by the Owner, on the basis of the lowest reasonable proposal of at least three (3) competitive proposals unless otherwise directed by Owner. If the actual cost of the materials and equipment delivered and unloaded at the site is more than all the allowance estimates, the Contract Sum will be adjusted by Change Order.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- ~~1~~ allowances-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,~~ miscellaneous fees, 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~~-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~~ Section 3.8.2.1 and (2) changes in Contractor's costs under ~~Section 3.8.2.2~~ Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner ~~with reasonable promptness in sufficient time to avoid delay of the Work.~~

§ 3.9 Superintendent

§ 3.9.1 The General 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 of the Work including punch list work. The Superintendents and Project Manager shall be satisfactory to the Owner and Architect and shall not be changed except with the consent of the Owner and Architect, unless the Superintendent leaves the employment of the Contractor. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architects objects to any nominated superintendent or project manager. The superintendent and project manager shall represent the Contractor, and communications given to the superintendent and/or project manager 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.~~

§ 3.9.2 The Contractor shall furnish to the Owner and the Architect in writing the names and professional qualifications of the persons proposed by the Contractor as the project manager and superintendent with the submitted proposal. The Contractor shall not assign nor substitute any person as the project manager or superintendent to whom the Owner or the Architect has made reasonable objection. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architect objects to any nominated project manager and/or superintendent. The Contractor's submittal of the project manager and superintendent's professional qualifications with his proposal represent the Contractor's acknowledgement that the selection committee's evaluation of the Contractor's proposal includes said superintendent's qualifications and the understanding that said job superintendent will remain on site, full time, until the Architect and Owner have agreed that all punch list work has been completed. See also, Specification Section 01 35 23 – Special Owner Requirements, for additional job superintendent requirements. In addition, the Owner reserves the right to perform a criminal records history review of the proposed superintendent and other Contractor personnel prior to the Contract Award as may be deemed necessary.

§ 3.9.3 Contractor will be required to keep the job superintendents on each job-site during the course of the construction until completion of all punch list items. In the event the job superintendents is absent from any job site at any time during the project contract time or during punch list completion and an agreed upon substitute is not provided, the Owner may backcharge the Contractor \$250.00 per occurrence.

§ 3.9.4 The Contractor shall notify the Owner and Architect at the beginning of the work day if the superintendent is out sick. If the superintendent is to be out for any other reason, the Owner and Architect are to be notified at least 24 hours in advance. In both cases the Owner and Architect are to be informed of the name of the acting superintendent.

§ 3.10 Contractor's Construction and Submittal Schedules

~~§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall Contractor shall, within the time frame specified in Section 01 32 16, prepare and 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 Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project. Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.~~

~~§ 3.10.2 The Contractor, Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit a submittal schedule the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably 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.~~

§ 3.10.4 The Contractor will provide a detailed critical path construction schedule including milestones for this project within the time frame specified in 01 32 16. This schedule shall be prepared using "Suretrak, Primavera, Microsoft Project" or other similar scheduling software. In addition, the Contractor shall submit to the Owner and Architect with each monthly Application for Payment a copy of the progress schedule showing all modifications required to have the schedule reflect appropriate revisions and shall take whatever action is necessary to assure that the project completion schedule is met. The Contractor is required to attend and to give a schedule update at each weekly construction administration meeting and shall provide a detailed 3 week work ahead schedule. The progress

schedule will include percentages of work completed to date along with percentages of work remaining to be completed. These percentages will be used in the verification of the Contractor's monthly Application for Payment. Pay Applications will not be processed by the Owner unless accompanied by an updated progress schedule. If the project is behind schedule, specific input will be required from the Contractor on how he intends to make up the time. If the project remains behind schedule for more than ten (10) working days, for any reason, the Owner, Architect, and Consultants and their associated personnel, shall be compensated by the Contractor, at their standard hourly billing rate, which will be provided as required, until such time as the Contractor can successfully demonstrate to all parties that the project is back on the agreed schedule. Contractor shall provide two (2) large format color prints one (1) for Owner and one (1) for jobsite of the construction schedule monthly with all items showing current status and original baseline schedule.

§ 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, maintain at the site for the Owner one (1) copy of the Drawings, Specifications, Addenda, Change Orders~~ and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and ~~the one (1) copy of approved Shop Drawings, Product Data, Samples, Samples~~ and similar required submittals. These shall be ~~in electronic form or paper copy~~, available to the Architect and ~~Owner, and shall be~~ delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, ~~diagrams, 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, equipment or workmanship~~ and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, ~~Samples, Samples~~ and similar submittals are not Contract Documents. Their purpose is to demonstrate ~~how the way by which~~ 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, 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, approve~~ and submit to the ~~Architect, Architect~~ Shop Drawings, Product Data, ~~Samples, Samples~~ and similar submittals required by the Contract ~~Documents, 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, separate contractors~~.

§ 3.12.6 By submitting Shop Drawings, Product Data, ~~Samples, 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, Documents~~, and (4) coordinated said shop drawings, product data, samples and submittals with adjacent work and its related submittals to be compatible and not in conflict for installation.

§ 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, Samples~~ or similar ~~submittals, 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, Samples~~ or similar ~~submittals, submittals~~ unless the Contractor has specifically ~~notified-informed~~ the Architect in writing 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. Samples or similar submittals by the Architect's approval thereof, except for any such errors or omissions which are within the Architect's statutory or contractual design responsibility.~~

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, ~~Samples, Samples~~ or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written 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, sequences~~ and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. 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 cause such services or certifications to be provided by a properly 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, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

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

§ 3.12.11 If, in the opinion of the Architect, the Shop Drawings are incomplete, indicate an inadequate understanding of the work covered by the Shop Drawings, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of any of the above deficiencies and subsequent resubmittal. Additional service charges may be charged to the Contractor by the Architect in this event.

§ 3.12.12 The Contractor shall submit drawings, data and samples to the Architect at least fifteen (15) Regular Work Days prior to the date the Contractor needs the reviewed submittals returned. The Architect and his consultants will be allowed fifteen (15) Regular Work Days for checking from date of submission of shop drawings that are acceptable and do not require re-submission in the opinion of the Architect. Where colors are to be selected by the Architect, submit all product color samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within eight (8) weeks [four (4) weeks for a summer remodel] of the Contractor's receipt of Notice to Proceed on the Project.

§ 3.12.13 The Contractor shall submit the number of copies of product data and samples which the Contractor and his subcontractors need for their use PLUS two (2) additional sets for the Architect, two (2) additional set for the Owner; one (1) additional set for each of the Architect's consultants involved with the particular Section of Work; (1) additional set of all mechanical shop drawings for TAB and one (1) additional set to be added to each copy of the Owner's Operation and Maintenance manuals at substantial completion. If, in the opinion of the Architect, the Shop Drawings are incomplete; indicate an inadequate understanding of the work covered by the Shop Drawings; or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of these deficiencies and subsequent resubmittal. Additional service charges as outlined in Article 3.2.7 may be charged to the Contractor by the Architect in this event.

§ 3.12.13.1 Where shop drawings are involved, submit one (1) high quality reproducible transparency and one (1) opaque print of the shop drawing for the Architect plus one (1) additional opaque print for each of the Architect's consultants involved with the particular Section of Work and one (1) additional print for each copy of the Owner's Operation and Maintenance Manuals to be submitted at Substantial Completion. The reproducible transparency will be marked by the Architect and/or his consultants and returned to the contractor for his use, distribution, correction or resubmittal, as required. After final review and correction of the submittal, the Contractor shall send one (1) corrected set to the Architect and one (1) to each of the Architect's consultants involved with the particular Section of Work. Contractor shall also retain one (1) set of all reviewed Mechanical submittals to be transmitted to the HVAC Test and Balance agency selected by Owner.

§ 3.12.14 The Contractor shall deliver in one (1) submittal, all material samples requiring a color selection by the Architect, within eight (8) weeks [four (4) weeks for summer remodel] of the Contractor's receipt of a Notice to Proceed on the Project. The Architect will return material color selections within six (6) weeks [three (3) weeks for summer remodel] of receipt of the color samples from the Contractor.

§ 3.12.15 The Contractor shall produce and submit for review, composite coordination drawings within four (4) weeks of the Contractor's receipt of a Notice to Proceed on the Project. The composite coordination drawings shall depict the coordination of all structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping in a composite above ceiling plan and a composite mechanical and electrical equipment room floor plan. Plans shall be produced at a scale of one-quarter (1/4") per foot and shall include larger scale sections with vertical elevations of elements required to confirm coordination of all elements. A schedule value for the production of the composite coordination drawings shall be included in the Continuation Sheet of the Application and Certificate for Payment for each of the Divisions of trade. Refer to specification section 01 31 13 for detail coordination document requirements.

§ 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, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.1 Contractor shall ensure that the Work, at all times, is performed in a manner that affords Owner reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The Work shall be performed in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of any area of the building adjacent to the site of the Work, or the building, in the event of partial occupancy.

§ 3.13.2 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories, toilets, entrances, and parking areas, other than those designated by the Owner. The Contractor shall comply with all rules and regulations established by the Owner in connection with the use and occupancy of the Project site and the Building.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, ~~fitting, fitting~~ or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, ~~fitting, or fitting and~~ patching shall be restored to the condition existing prior to the cutting, ~~fitting, or fitting and~~ 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 separate contractors~~ by cutting, ~~patching, patching~~ or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter ~~such~~ construction by the Owner or a ~~Separate Contractor separate contractor~~ except with written consent of the Owner and of ~~the Separate Contractor. Consent such separate contractor; such consent~~ shall not be unreasonably withheld. The Contractor shall not unreasonably ~~withhold, withhold~~ from the Owner or a ~~Separate Contractor, its separate contractor the Contractor's~~ consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor ~~shall shall, on a daily basis,~~ keep the premises and surrounding area free from accumulation of waste materials ~~and or~~ 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, machinery~~ and surplus materials from and about the Project. See specification section 01 71 50 for specific requirements of final cleaning.

§ 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.

§ 3.15.3 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; clean roofs; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect a job site plan and 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 such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, Third Party consultants, utility service providers involved with the project, and agents and employees of any of them from and against claims, damages, ~~losses, losses~~ and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, ~~loss, 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, them~~ or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, ~~loss, 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 which~~ would otherwise exist as to a party or person described in this ~~Section 3.18. Section 3.18.~~

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

ARTICLE 4—ARCHITECT

§ 3.19 Substitutions of Materials, Products, or Systems

§ 3.19.1 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 is approved in an addendum as a substitution prior to the submission of proposals. If prior written approval has not been obtained, it will be assumed that the Proposal is based upon the materials, products, and systems described in the Proposal Documents and no substitutions will be permitted, except as provided hereinafter.

§ 3.19.2 If, prior to submitting his Proposal, a Proposer at any level determines that any of the materials, 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 Proposer shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes shall be set forth in an addendum.

§ 3.19.3 The Architect does not bind himself to consider a substitution during the proposal period unless written request has been submitted to the Architect for approval at least ten (10) days prior to the date for receipt of Proposals. Each such request shall include a "side-by-side" comparison which may include but is not limited to the following; a complete description of the proposed substitute, the name of the material, project, or system for which it is proposed to be substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete

evaluation. Incomplete submittals will not be evaluated. If the Architect approves any proposed substitution, such approval will be set forth in an Addendum.

§ 3.19.4 If, after award of contract, the Contractor or one of his Subcontractors or Suppliers determine 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 accomplished by appropriate modification.

§ 3.20 Record Drawings

§ 3.20.1 Within seven (7) days after substantial completion of the project, the Contractor shall submit two (2) sets of full-size photocopies of the Job Superintendent's field set of marked plans and specifications.

§ 3.20.2 The Contractor shall provide the Owner with Electronic Record Drawings on a thumb drive or solid-state media drive. Drawings shall mirror the construction document sheets with any additions and changes made during the course of the project. Drawings shall be in both AutoCAD version 18 or later, and PDF or Tiff Format. CAD files shall have all referenced drawings in the same directory or folder. The record drawings shall include electronically all changes made during construction, clouded and keyed to identify the instrument of the change, Change Proposal Request or Change Order. For underground utility piping, revised locations shall also be dimensioned from the column grid lines. The record drawings must be delivered to the Architect at least thirty (30) days prior to receipt of the Contractor's Final Application for Payment. The record drawings shall have a statement added to indicate the purpose of the drawings (i.e. "RECORD DRAWINGS") and shall delete the Architects and/or Engineers seal. See additional requirements in Form 'AO'.

§ 3.20.3 The Contractor is to provide the Owner with Record Specifications (one (1) PDF format on thumb drive or solid-state media drive) which denotes the manufacture of materials incorporated into the Project where more than one acceptable manufacturer is listed, and shall include all changes made during construction, clouded and keyed to identify the instrument of change. The record specifications shall have a statement added to indicate the purpose of the specifications (i.e. "RECORD SPECIFICATIONS"). See additional requirements in Form 'AO'.

§ 3.21 Antitrust Violations

§ 3.21.1 To permit the Owner to recover damages suffered; in antitrust violations, the Owner/Contractor Agreement shall include the following wording, "Contractor hereby assigns to Owner any and all claims for overcharges associated with this contract which are under the antitrust laws of the United States, 15 U.S.C.A., Sec. 1 et.seq. (1973)". The Contractor shall include this provision in his agreements with each subcontractor and supplier. Each subcontractor shall include such provisions in agreements with sub-subcontractors and suppliers

§ 3.22 Prevailing Wage Rates

§ 3.22.1 No employee used in this construction may be paid less than the minimum wage rate provided herein in Article 15.

§ 3.23 Construction Progress Photographs

§ 3.23.1 Contractor shall provide color construction progress photographs during the construction period on a monthly basis to the Architect and Owner. Photographs and digital files on thumb drive or solid-state media drive of photos shall be provided. Construction progress monthly photographs (24 minimum per month, showing all aspects of work accomplished during that month) shall be provided with each and every application for payment.

§ 3.23.2 For New Construction, Building Additions and Miscellaneous Renovations provide (Digital files on thumb drive or solid-state media drive):

Two (2) aerial photographs prior to construction

Two (2) aerial photographs after Final Completion, and

Two (2) aerial photographs of the District facility site each month that there is a change in appearance of the building exterior and site, or as requested by the Owner.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

§ 4.1 General Architect

§ 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~~ lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

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

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

§ 4.1.4 Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Construction Documents and the Contract Documents by the duties, responsibilities, or activities of the Architect.

§ 4.2 Architect's 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. (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2.~~ The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract ~~Documents. Documents unless otherwise modified in writing in accordance with other provisions of the Contract.~~

§ 4.2.2 The Architect ~~will visit the site at~~ shall visit the site at least twice per week (or more per week when deemed necessary by the Owner's Superintendent or Designee or when necessary to protect Owner's interests) and at any other 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 to inspect the progress, quantity and quality of the Work completed, to reject any observed nonconforming Work, and to determine if the Work 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. the Construction Documents and the Contract Documents and on time. Furthermore, a minimum of two job site meetings per month from commencement of construction through Final Completion will be initiated by the Architect and attended by the Contractor. Attendees will include Owner, the Contractor's project manager and/or superintendent, Architect's project representative, and Architect. The Architect, Owner and their representatives shall at all times have access to the Work. Architect, or its structural consultant will provide on-site observation prior to and during all concrete pours that contribute to the structural integrity of the building, including all pours of concrete piers, footings, grade beams, floor slabs, and concrete superstructure components, if applicable. In addition, Architect or its structural consultant will provide on-site observation prior to covering up or closing up of portions of the construction, which if covered, would conceal problems with the structural integrity of the Project. Contractor shall not close or cover said Work until said observations have occurred. Contractor or Architect will advise Owner of the need for any third-party laboratory or testing services to assist the Architect and Owner. On the basis of the on-site observations by Architect, Architect shall keep Owner and Contractor informed of the progress and the quality of the Work, through Architect's field reports, and shall guard Owner against defects and deficiencies in the Work. Architect shall promptly notify Owner and Contractor, orally, regarding any defect or nonconforming Work, which shall be followed by notice in writing of defects or nonconforming Work noted and corrective action taken or recommended. The Architect, however, shall not have control over, or responsibility for the Contractor's construction means, methods, techniques, sequences, procedures, or safety programs, but this does not relieve Architect of Architect's responsibilities under this Agreement. Any services by Contractor made necessary by Contractor's construction defect or nonconforming Work, shall be performed at no additional cost to Owner.

§ 4.2.3 ~~On the basis of the site visits, the~~ 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~~ Documents and from the most recent construction schedule submitted by the Contractor, and (3) (2) 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, of~~ and will not be responsible for acts or omissions ~~of, of~~ the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of ~~the Work. The Architect shall endeavor to guard the Owner against defects and deficiencies in~~ the Work.

§ 4.2.4 Communications Facilitating Contract Administration

~~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 Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with Separate Contractors separate contractors shall be through the Owner. The Contract Documents may specify other communication protocols.~~

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require ~~additional~~ inspection or testing of the Work in accordance with Sections ~~13.4.2 and 13.4.3, 13.5.2 and 13.5.3,~~ whether or not ~~the such~~ 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, ~~material and equipment~~ suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will ~~review and approve, review,~~ or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product ~~Data, 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 ~~as to cause no delay in the work or in the activities of the Owner, Contractor, or Subcontractor,~~ 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, Sections 3.3, 3.5~~ and 3.12. The Architect's review shall not constitute approval of safety precautions ~~or or, unless otherwise specifically stated by the Architect,~~ of any construction means, methods, techniques, ~~sequences, 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-Orders, Change Proposal Requests,~~ and Construction Change Directives, and may ~~order-authorize~~ 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. Section 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; will~~ receive and forward to the ~~Owner, 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 Contractor, and will~~ issue a final Certificate for Payment ~~pursuant to Section 9.10 upon compliance with the requirements of the Contract Documents.~~

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more ~~Project-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. ~~If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.~~

§ 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, 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. Contractor shall not cover up any work without the Architect and Owner performing an observation of such work. The Contractor will be responsible for any and all associated costs to allow for observations of the work, uncovered, by the Architect and Owner if the Contractor covers work without either the consent of the Architect and Owner or without providing the Architect and Owner with reasonable opportunity to observe the work, whether or not such work is found to be acceptable by the Architect or Owner.~~

§ 4.3 Claims and Disputes

§ 4.3.1 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. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.3.2 Time Limits on Claims. Claims by either party must 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. Claims must be initiated by written notice to the Architect and the other party.

§ 4.3.3 Continuing Contract Performance. Pending final resolution of a Claim unless as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract.

§ 4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which 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, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if 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 an equitable adjustment 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 so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within twenty-one (21) days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be

equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

§ 4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.6.

§ 4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 4.3.

§ 4.3.7 Claims For Additional Time

§ 4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein 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.

§ 4.3.7.2 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.

§ 4.3.8 Injury or Damage to Person or Property. If either party to the Contract 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, written notice of such 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.

§ 4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 4.3.10 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 without limitation:

- .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 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 4.4 Resolution of Claims and Disputes

§ 4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for recommendation. If the parties are unable to agree, an appeal may be submitted as stated in Section 4.4.1.1 below.

§ 4.4.1.1 Any claim, disputes or matters arising out of this contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

§ 4.4.2 The Architect will review Claims and within ten (10) days of the receipt of the Claim take one or more of the following preliminary actions: within ten (10) days of receipt of claim: (1) request additional supporting data from

the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating the reasons for rejection, (4) recommend approval of the Claim by the other party, or (5) suggest a compromise.

§ 4.4.3 In evaluating Claims, the Architect 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 Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

§ 4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation.

§ 4.4.6 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or 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 Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.4.7 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 prior to resolution of the Claim by the Architect, or by mediation.

§ 4.4.8 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven (7) days.

Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be possibility of a Contractor's default, the Architect shall notify the surety and request the surety's assistance in resolving the Claim.

§ 4.5 Mediation

§ 4.5.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 4.3.10, 9.10.4 and 9.10.5 shall, after initial decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to mediation only upon the mutual consent of both parties. In the event that mutual consent is not achieved, the parties are free to pursue any claims, disputes or matters in any manner allowed by law.

§ 4.5.2 Mediation, 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 and with the American Arbitration Association.

§ 4.5.3 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.

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.

§ 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.~~

§ 5.2.1 As soon as practicable after award of the Contract, but not later than five (5) days prior to the submittal date for the Contractor's first Application for Payment, the Contractor shall furnish in writing to the Owner and the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. Where subcontractors have been listed in the Specifications or on the Contractor's Proposal Form, the proposed entities shall be those firms listed in the Specifications and on the Contractor's Proposal Form, unless an agreement has been reached with the Owner to accept a proposed substitute(s). The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no objection. Failure of the Contractor to submit the subject names in a timely manner will delay processing of the Contractor's Application for Payment.

~~§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and a timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.~~an objection under provisions of Subparagraph 5.2.1.

~~§ 5.2.3 If the Owner or Architect has reasonable objection Contractor has acted promptly and responsibly in submitting names as required, and the Owner or Architect objects 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 objection. The Contract Sum 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 responsibly in submitting names as required.~~

§ 5.2.4 Prior to any substitution of a subcontractor by the Contractor, the Contractor shall notify the Architect of his intent and reasons for such proposed substitutions. The Contractor shall not substitute a Subcontractor, person, person or entity for one previously selected if the Owner or Architect makes reasonable objection objects to such substitution.change.

§ 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.~~

§ 5.2.5 The Contractor shall submit the list of proposed Subcontractors on AIA Document G805 or the form provided in the Project Manual.

§ 5.2.6 The Contractor is required to visit the site and completely familiarize himself with the existing conditions prior to the proposal. Neither additional increase in the Contract Sum nor extension in Contract Time will be granted when existing or known conditions require a certain amount of work to comply with the intent of the Contract Documents.

§ 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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. 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. Each subcontractor shall provide proof of insurance to Contractor consistent with the Contractor's insurance to Owner and in an amount commensurate with the Work to be performed by the Subcontractor.

§ 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~~ Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and ~~Contractor~~ Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

~~When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.~~

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

~~§ 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.~~

§ 5.5 Neither the Owner nor the Architect shall be obligated to pay or to ensure the payment of any monies to subcontractors due to any non-payment to the Contractor or non-payment of subcontractors by the Contractor.

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 to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Section 4.3.~~

§ 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~~ separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with ~~any Separate Contractors~~ other separate contractors and the Owner in reviewing their construction ~~schedules, schedules when directed to do so.~~ The Contractor shall make any revisions to ~~its~~ the 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,~~ 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 forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor~~ under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article ~~6, and Articles 10, 11, 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, 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 report to the Architect apparent discrepancies or defects in such other construction 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 such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or Separate Contractor's 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. Work, except as to defects not then reasonably discoverable.~~

§ 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~~ Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective ~~construction.~~ construction of the Contractor. 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.~~ construction of a separate contractor.

§ 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.

§ 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, Change Proposal Request, Construction Change ~~Directive or Directive~~, order for a minor change in the Work, or a Change Proposal Request issued by Architect or Contractor, signed by Owner, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 ~~A Change Order All Change Orders and Change Proposal Requests~~ shall be based upon agreement among the Owner, ~~Contractor, and Architect. A 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 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, Documents, and the Contractor shall proceed promptly,~~ unless otherwise provided in the Change Order, ~~Construction Change Directive, Change Proposal Request 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.

§ 7.2.2 The parties mutually may agree upon a Change Order that adjusts Contract Time and/or Contract Sum based on a change in the Scope of Work requested by the Owner or that results from unanticipated, extraordinary adverse weather conditions as described in Article 15 of these General Conditions. The parties further agree that Contractor shall proceed with the Work only as set forth in a Change Order upon Contractor's physical receipt of a Change Order duly executed by the Owner. Contractor shall be entitled to reimbursement of a previously agreed to cost for estimating services.

§ 7.2.3 If a change in the Work is to be ordered, a written request shall be issued by Owner to Contractor describing the change and requesting the submission of a Change Order Request. When time does not permit the processing of a Change Order in advance of commencing the change in the Work, upon receipt of a written authorization from Owner, Contractor shall proceed with a change in the Work pursuant to a Construction Change Directive and Contractor shall concurrently proceed with submission of a Change Order Request.

§ 7.2.4 Within thirty (30) days following receipt of a written request, Contractor shall submit a Change Order Request to Owner together with the revised or new documents which, if approved, will become part of the Contract Documents setting forth any requested adjustment in the Contract Sum or the Contract Time, and including an itemization of all costs of material and labor with extensions listing quantities and total costs, and a substantiation of any Claim for an extension of the Contract Time. Any Change Order for a change in the work must be signed by the Owner before the Owner is obligated for payment related to the Change Order. If Contractor is unable to submit the above information within the time limit, it shall notify Owner in writing, setting forth for Owner's approval a date by which Contractor will submit the information as well as a schedule for the performance of the Work for which a Change Order Request will be forthcoming. If within the 30 days the Construction Manager cannot ascertain the financial or time impact of a claim a letter alerting the Owner of a forthcoming claim will suffice. This must be sent during this 30-day window.

§ 7.2.5 If Owner accepts a Change Order Request submitted by Contractor, Contractor shall prepare a Change Order that is based upon such Change Order Request for execution by Contractor and Owner and to the extent that the

Owner and Contractor agree, the Contract Sum and Contract Time shall be adjusted as provided in the Change Order upon execution of such Change Order.

§ 7.2.6 Nothing contained herein shall limit the right of Owner to order changes in Work by Change Orders that have not been signed by Contractor, and Contractor shall promptly perform all Work required under the Contract Documents or a Change Order despite its failure to execute the Change Order. However, the Owner shall issue and execute a Change Order authorizing payment for all undisputed amounts.

§ 7.2.7 No change in the Work shall be the basis of an addition to the Contract Sum or a change in the Contract Time unless and until such change has been authorized by a Change Order executed and issued by the Owner in accordance with the Contract Documents. Changes in the Work may be made without notice to Contractor's sureties and absence of such notice shall not relieve such sureties of any of their obligations to Owner.

§ 7.2.8 Acceptance of a Change Order by the Contractor shall constitute full accord and satisfaction for any and all Claims, whether direct or indirect, including but not limited to, impact or delay damages, arising from the subject matter of the Change Order; or attorneys' fees and costs arising from a dispute with a Subcontractor over the Change Order.

§ 7.2.9 Methods used in determining adjustments to the Contract Sum shall be those listed in Section 7.3.3.

§ 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 and/or Change Proposal Request 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:~~ The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more ways listed below. 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** ~~Mutual~~ By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation; evaluation. Contractor shall provide on company letterhead backup documentation and submit proposal cost and/or by either using unit costs method with attached supporting data or by using labor, materials and equipment method with attached supporting data. One form shall be utilized by each trade involved in the change in the work with an overall summary form by the Contractor for the entire change. Where additional Work is involved, the lump sum shall represent the estimated cost of labor and materials; plus markups to cover miscellaneous fees and profit if not funded by an allowance;

To compensate the Contractor or Subcontractor actually performing a part of the Work for the combined cost of miscellaneous fees and profit, the performing party shall be entitled to a single markup not to exceed 15% of the estimated cost of that part of the Work.

To compensate the Contractor for the combined cost of miscellaneous fees and profit on work performed by Subcontractors, the Contractor shall be entitled to a single markup not to exceed 10% of the subcontract amount if not funded from an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

When a Sub-subcontractor performs the Work of a change, the 15% markup for combined miscellaneous fees and profit shall be used only by the Sub-subcontractor. The Subcontractor and Contractor would each be entitled to a single markup not to exceed 10% of the cost to them from the Subcontractor and sub-subcontractor respectively if not funded by an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

- .2 Unit-By unit prices stated in the Contract Documents or subsequently agreed upon; Additional markups for miscellaneous fees, and profit will not be allowed in Unit Price Work;
- .3 Cost-By 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~~ in Subsection 7.3.6.
- .5 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 itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above on company letterhead. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.
- .6 For changes in the work the Contractor, Owner and Architect agree to be bound by the below stated required time lines.

Upon issuance of a Change document, Contractors, Subcontractors and Sub-subcontractors shall provide the proposed pricing on company letterhead with the required supporting back up documentation no later than fifteen (15) business days after receipt of the proposed change document. Architect and Owner shall review Contractor's pricing and within ten (10) business days accept pricing as submitted by the Contractor or reject the pricing and return to the Contractor with specific reasons for rejections. If pricing is rejected, Contractor shall review the specific rejections and modify pricing to address the specific rejection and resubmit to the Architect and Owner comments within two (2) business days after receipt of rejection comments. The Architect and Owner shall review the revised pricing and either accept the revised pricing, or if pricing is still in dispute, the Architect shall issue a Construction Change Directive.

§ 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;~~
- ~~.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.~~ 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.

§ 7.3.5 ~~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-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.~~

§ 7.3.6 ~~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.~~ If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect or Owner shall determine the method and 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 miscellaneous fees, overhead and profit except if funded by Allowance. 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 7.3.7 shall be limited to the following:

- .1 costs of labor, including social security, retirement and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others, and;
- .4 additional costs of supervision and field office personnel directly attributable to the change.

§ 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. 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 miscellaneous fees and profit shall be figured on the basis of net increase or decrease, if any, with respect to that change.

§ 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. Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by an approved Change Order or Change Proposal Request indicating the parties' agreement with part or all of such costs. For any portion of such costs that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. The 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 4.

§ 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. 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 shall be recorded by preparation and execution of an appropriate Change Order.

§ 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. § 7.4.1 The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents with Owner's written approval. Such changes will be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly with Owner's written approval.

§ 7.5 Changes Funded by Allowances

§ 7.5.1 Allowance balances may be used to fund changes in the work. The Contractor will not be allowed a mark-up for overhead and profit when changes in the work are funded by one of the Allowances. Cost for changes funded by allowances shall be determined by methods described in Article 7.3.3. Miscellaneous fees and profit mark-up shall be allowed on work performed by Subcontractors, Sub-subcontractors and the Contractor's own forces, in accordance with Section 7.2 and 7.3.

§ 7.5.2 Changes funded by Allowances shall require back-up documentation per Section 7.3.3.

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. Unless agreed otherwise, the date inserted on the Agreement form and the Date of Commencement constitute "0" (zero) of the stated Completion Time.

§ 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. The term "regular working day" as used in the Contract Documents shall mean any day from Monday through Friday, exclusive of those holidays normally recognized in the construction industry and/or approved by District-approved calendar.

§ 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 prematurely~~ commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner, and approved by the Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five (5) days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 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, or~~ (1) an act or neglect of the Owner or Architect, or ~~an employee of either, or of a Separate Contractor; (2) separate contractor employed by the Owner; or~~ an employee of either, or of a Separate Contractor; (2) separate contractor employed by the Owner; or 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 by fire, or~~ (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or by fire, or other causes beyond the Contractor's control; ~~(4) or~~ (4) or 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, arbitration; or by other causes that the Architect and Owner determines may~~ or (5) by other causes that the Contractor asserts, and the Architect determines, arbitration; or by other causes that the Architect and Owner determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect and Owner may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article ~~15.4~~.

§ 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.

§ 8.3.4 Extensions of time granted for causes described herein will be granted on the basis of one Regular Working Day extension for each Regular Working Day lost (i.e. seven (7) Calendar Days extension will be granted after five (5)

Regular Work Days are lost except as modified by the provisions contained herein related to Anticipated Weather days).

§ 8.3.5 Each Proposer shall include in his proposed construction schedule an allowance of regular work days per year as defined in 1.7.7.4, in which work is delayed for student testing or other unspecified campus events. In addition, each proposer shall include an allowance of Anticipated Weather Days in accordance with following:

Number of anticipated Weather Days (These are regular working days)

<u>January</u>	<u>5</u>	<u>July</u>	<u>8</u>
<u>February</u>	<u>5</u>	<u>August</u>	<u>8</u>
<u>March</u>	<u>5</u>	<u>September</u>	<u>7</u>
<u>April</u>	<u>4</u>	<u>October</u>	<u>4</u>
<u>May</u>	<u>7</u>	<u>November</u>	<u>6</u>
<u>June</u>	<u>7</u>	<u>December</u>	<u>5</u>

§ 8.3.6 Weather Days shall pertain to such items as rain, flooding, snow, unusually high winds, excessively wet grounds, or the like which prevent progress on major portions of the work on regular working days only. If such situations occur on more than the number of Anticipated Weather Days indicated above and if those additional days prevent the Contractor from performing critical portions of the scheduled work, extensions of time cause by inclement weather may be requested as enumerated hereinafter: if the inclement weather is rain related, the rain at the site must have been in excess of 0.5 inch in 24 hours.

§ 8.3.7 At the beginning of each month the Contractor shall submit a status report for the preceding month, showing 1) the scheduled number of Anticipated Weather Days for the particular month, 2) the actual Weather Days requested, and 3) the Net Weather Days (plus, minus, or no change). At times deemed appropriate by the Architect or when requested in writing by the Contractor, the Contract time will be adjusted by Change Order if the total of Net Weather Days is substantially greater than "0". Unused Anticipated Weather Days may be accumulated during the Contract Time and may be used to offset Actual Weather days in other months. If the Contractor fails to submit said monthly status report, it will be assumed that none of the Anticipated Weather Days were used for that month and that they shall accumulate for possible future offset against Net Weather Days; however, if at the end of the project all Anticipated Weather days have not been used, the contract completion time will not be reduced. An example of the monthly schedule to be submitted is as follows:

<u>Month</u>	<u>Anticipated Weather Days (Regular)</u>	<u>Actual Weather Days (Regular) Requested</u>	<u>Net Weather Days (Regular)</u>
<u>January</u>	<u>5</u>	<u>11</u>	<u>6</u>
<u>February</u>	<u>5</u>	<u>0</u>	<u>-5</u>
<u>March</u>	<u>5</u>	<u>2</u>	<u>-3</u>
<u>April</u>	<u>4</u>	<u>2</u>	<u>-2</u>
<u>May</u>	<u>7</u>	<u>12</u>	<u>5</u>
<u>June</u>	<u>7</u>	<u>11</u>	<u>4</u>
<u>Totals</u>	<u>33</u>	<u>38</u>	<u>5</u>

Using this example (and assuming that all requested days were approved) there were 5 Net Weather Days (regular) for the six (6) months of the project and the extension of Contract Time would be seven (7) Calendar Days).

§ 8.3.8 Extensions of the Contract Time will only be considered after the number of anticipated delay days has been expended through mutual agreement by the Owner, Architect and Contractor.

§ 8.3.9 The following is a requirement of the Contract and will be included in the Agreement Between Owner and Contractor under Time of Completion and the blank spaces will be completed indicating the completion date as stated on the Proposal Form.

§ 8.3.10 The Work to be performed under this Contract shall be commenced in accordance with Section 8.1.2 and the following Substantial Completion Date(s) must be achieved. Refer to the Project Manual for description of Phasing, if any.

1. Refer to Document A101-2017 Standard Form of Agreement Between Owner and Contractor as amended, Article 3.3 for required substantial completion date(s).

The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult to ascertain. Refer to Section 8.4 for Liquidated Damages.

§ 8.4 Liquidated Damages

§ 8.4.1 The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult of ascertainment. The sums per Calendar Day to be paid in consideration of all actual costs such as rental costs, additional supplies, labor, overtime, and especially disruption of the educational programs and lost administrative time, which cannot be readily determined are as follows:

<u>Elementary Schools (New Construction and/or Renovations):</u>	<u>\$1,000.00/Calendar Day</u>
<u>Middle Schools (New Construction and/or Renovations):</u>	<u>\$2,000.00/Calendar Day</u>
<u>High Schools (New Construction and/or Renovations):</u>	<u>\$3,000.00/Calendar Day</u>
<u>Athletic Fields (New Construction and/or Renovations):</u>	<u>\$1,000.00/Calendar Day</u>
<u>Miscellaneous Facilities (New Construction and/or Renovations):</u>	<u>\$1,000.00/Calendar Day</u>

§ 8.4.1.1 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 an equitable sum per Calendar Day for each and every Calendar Day beyond the specified date of Substantial Completion, which the Contractor shall require for Substantial Completion of the Work included in this Contract. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the work is not completed within the agreed time, or within the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as Liquidated Damages only and in no sense shall be considered a penalty, said damages being caused by additional compensation to personnel, for loss of interest on money, and other increased costs, all of which are by their nature difficult of exact ascertainment.

§ 8.4.1.2 If the Contractor fails to complete all requirements of Final Completion within ninety (90) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the job site or Owner's office until such time as the close-out documents and all punch list items are completed and accepted by Owner. During this time the General Contractor will be charged for the Owner's, Architect's, and any consultant's time. Billable time will include without limitation travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions. These weekly meetings shall include a minimum two (2) hour charge per participant. Costs will be deducted from Contractor's Final Payment. Hourly rates shall be as follows:

Consultants:

- Principal Architect/Engineer/Consultant: \$175.00
- Project Architect/Engineer/Consultant \$150.00
- Staff Architect/Engineer/Consultant \$120.00
- Field Representative/Architect/Engineer/Consultant \$100.00

- Secretarial \$ 50.00

Project Owner:

- Associate Superintendent \$225.00
- Assistant Superintendent \$200.00
- Director \$175.00
- Senior Project Manager \$165.00
- Project Manager \$150.00
- Project Coordinator \$120.00
- Secretarial \$ 50.00
- Maintenance Technician \$ 50.00
- Operations Personnel \$ 33.00

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.~~

Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect and Owner may require. This schedule, unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.2.2 In order to facilitate the review of Applications for Payment, the Schedule of Values shall be submitted on AIA Documents G702 and G703 or other similar forms approved by the Owner, and shall include the following:

- 1 General Contractor's costs for Contractor's fee, bonds and insurance, mobilization, project close-out etc., shall be listed as individual line items.
- 2 Contractor's costs 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.
- 3 On major subcontracts, such as mechanical, electrical, plumbing, and low voltage, the schedule shall indicate line items and amounts in detail (e.g. underground, major equipment, fixtures, installation of fixtures, start up, close-out, etc.)
- 4 Costs for subcontract Work shall be listed without any addition of General Contractor's costs for miscellaneous fees, profit or supervision.
- 5 Where payment for stored materials may be requested prior to installation, material and labor shall

be listed as separate line items. Stored materials will only be paid for the amount of actual invoices of same materials.

.6 Sample pages from an approved schedule of values are included in Section 01 29 73 of the project specifications.

.7 Where work occurs at more than one building, for the Owner's accounting purposes and to facilitate the checking and verification of the Contractor's Application for Payment, cost shall be scheduled separately for each building on the G703 Continuation Sheets. Building additions and renovations shall be listed separately.

.8 All work outside the building envelope excluding overhangs and canopies shall be listed separately under Site work.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment ~~prepared for operations completed~~ in accordance with the schedule of ~~values, if required under Section 9.2, for completed portions of the Work. The values.~~ Prior to this submittal, the Contractor shall contact the Architect's Field Department and Owner for on-site review of the proposed application. On-site reviews shall include review of all lien releases and stored materials. See project manual for additional requirements. Upon approval by the Architect's Field Department and Owner, the Application for Payment shall be notarized and submitted to the Architect. Included shall be data required to support lien releases, Application for Payment Checklist (Section CA), invoices and/or receipts. Such application shall be notarized, if required, and supported by ~~all such~~ 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 as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting~~ retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in ~~Section 7.3.9, Section 7.3.8,~~ 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, Change Proposal Requests,~~ 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 whom the Contractor intends to pay.

§ 9.3.2 ~~Unless otherwise provided in the Contract Documents, payments shall~~ Payments will 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/or equipment 1) incorporated in the Work and 2) Suitably stored at the site or 3) suitably stored at some off-site location provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site storage area.

.5 All items shall be marked and clearly tagged as property of the Owner.

Payments for materials or equipment stored on or off the site shall be conditioned upon ~~compliance by the Contractor with submission by the Contractor of bills of sale or such other~~ procedures satisfactory to the Owner to establish the Owner's title to such materials ~~and/or~~ 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 including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment. Contractor shall only be paid for the amount of the actual invoices submitted as backup for stored materials.~~

The Contractor acknowledges that the review of materials stored off site is an additional service of the Architect and shall be charged for that service. The cost for that service will be established by the Architect and is not subject to appeal.

§ 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, information~~ and belief, be free and clear of liens, claims, security ~~interests, or encumbrances, interests or encumbrances~~ in favor of the Contractor, Subcontractors, ~~material~~ suppliers, or other persons or entities ~~that provided labor, materials, making a claim by reason of having provided labor, materials~~ and equipment relating to the Work.

§ 9.3.4 Contractor's progress payment draws for fees and general conditions (including miscellaneous fees and profit) shall not exceed the percentage completion of the Work in place for the entire Project as indicated on the Application for Payment.

§ 9.3.4.1 By signing each Application for Payment, Contractor stipulates and certifies the following: that the information presented is true, accurate, and complete; that the Contractor has made the necessary detailed examinations, audits, and arithmetic verifications that the submitted Work has been completed to the extent represented in the Application for Payment, that the materials and supplies identified in the Application for Payment have been purchased, paid for, and received; that the subcontractors have been paid as identified in the Application for Payment or that the Contractor has been invoiced for same; that he has made the necessary on-site inspections to confirm the accuracy of the Application for Payment; that there are no known mechanics' or materialmen's liens outstanding at the date of this requisition; that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmen's liens on the Work; that the Payment Application includes only Work self-performed by Contractor or for which Contractor has been invoiced; and that releases from all subcontractors and materialmen have been obtained in such a form as to constitute an effective release of lien under the laws of the State of Texas covering all Work performed and for which payment has been made by the Owner to the Contractor.

§ 9.3.5 Contractors shall submit digitally one (1) application using AIA Document G702 and G703, Application and Certificate for Payment, 1992 Edition. All blanks in the form must be completed and signatures of Contractor and Notary Public must be original on each form.

§ 9.3.6 Contractor shall submit Application to the Architect in sufficient time (no later than Thursday at noon) to ensure that the Architect submits Application to the Owner on the first Monday of the Month (or previous business day if Monday is a Holiday as defined in this Agreement), prior to 12:00 pm. Applications will not be accepted on any other day of the week.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment, either (+) 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 Contractor, for such amount as the Architect determines is properly due, and or notify the Contractor and Owner in writing 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 or in part 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-comprising~~ the Application for Payment, that, to the best of the Architect's knowledge, ~~information, information~~ and belief, the Work has progressed to the point ~~indicated, indicated and that~~ the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. Documents. 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, completion~~ and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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, Work~~, (2) reviewed

construction means, methods, techniques, ~~sequences, or procedures; sequences or procedures.~~ (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to ~~payment; 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.

§ 9.4.3 The Architect will affix his signature to the same form described in Paragraph 9.3.4 to signify his certification of payment provided the application is otherwise satisfactory.

§ 9.4.4 The issuance of a Certificate for Payment shall constitute a recommendation to the Owner regarding the amount to be paid, this recommendation is not binding on the Owner if the Owner knows of other reasons under the Contract Documents why payment should be withheld.

§ 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; or
- .7 ~~repeated-persistent~~ 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, the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.~~

~~§ 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 (7) 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, pay~~ or to see to the payment of money ~~to, to~~ a Subcontractor ~~or supplier~~, except as may otherwise be required by law.

§ 9.6.5 ~~The Contractor's payments to~~ Payments to material and equipment 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 and~~ 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of ~~trust, or trust or shall~~ 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.~~

§ 9.6.8 Based upon Applications for Payment and supporting documents including monthly updates of record drawings 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 in the conditions of the Contract as follows:

95% of the proportion of the Contract Sum properly allocable to labor, materials and equipment incorporated in the Work and 95% of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing by the parties; less the aggregate of previous payments in each case; and upon Substantial Completion of the entire work, a sum sufficient to increase the total payments to 95% of the Contract Sum less such retainages as the Architect shall determine for all incomplete work and unsettled claims.

Owner reserves the right to require that conditional Lien Releases be submitted by the Contractor and all subcontractors, sub-subcontractors and major suppliers with each Application for Payment after the first Application for Payment for which payment was made by the Owner for the certified amount for all previous applications for payments. Owner may withhold payment on-line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received by Owner.

Contractor shall not withhold as retainage a greater percentage for the Subcontractors or materialmen than the percentage that Owner withheld as retainage from payments to the Contractor.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for ~~Payment, Payment or notify Contractor of rejection,~~ through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract ~~Documents, Documents~~ the amount certified by the ~~Architect or awarded by binding dispute resolution, Architect,~~ then the Contractor may,

upon seven (7) additional days' written 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~~, shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.7.1 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, then such payment shall be made promptly upon demand by the Owner. Any payments that are past due more than thirty (30) days after the Owner's invoice date may result in owner's rejection of Application for Payment.

§ 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.~~ is sufficiently complete for the Owner to occupy, operate, and maintain the Work. Owner and Architect shall make the final determination as to which provisions of the Contract Documents are necessary to meet this criteria, whether or not such requirements are specifically enumerated in this Section or in other portions of the Contract Documents as being specifically required for Substantial Completion.

§ 9.8.1.1 The following items are a partial list of requirements, as applicable to the Project, that must be completed prior to the established Substantial Completion. This is not intended to be an exhaustive list, but a guideline:

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. All inspections by government authorities having jurisdiction over the project must have been finalized, any remedial work required by them must have been completed, and Certificates of Occupancy, local fire marshal and health department approval certificates and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
3. All exterior clean-up and landscaping must be complete, including required stand of grass mowed, edged, weeded, and fertilized.
4. All interior shall have been completed and cleaned except minor items which, if complete after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. Contractor shall provide list of these specific items, which include punch list and completion items. 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 shall be the sole judge of what constitutes a significantly large number of items.
5. All third-party HVAC air and water balancing must be complete.
6. All energy management systems must be complete, fully operational and demonstrated to the Owner, with graphics transferred to the main server.
7. All emergency/standby generator and low voltage lighting control systems must be complete, fully operational and demonstrated to the Owner.
8. All security systems must be complete, fully operational and demonstrated to the Owner, and must be monitorable from the District's central Police/Security Center.
9. All school communications equipment, telephone systems and P.A. systems must be complete and demonstrated to the Owner.
10. All final lockset cores must be installed and all final Owner directed keying completed.
11. All room plaques and exterior signage must be complete.
12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment and all life safety systems.
13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
14. All operation and maintenance manuals are delivered and approved by Architect and Owner ("D-slant" ring binders in duplicate).
15. Health Department Inspections and Municipal Utility District (MUD) and Drainage District and County approvals must be provided.
16. All other reports, testing results, certifications, studies, etc. required by Contract Documents.

§ 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~~ occupy, operate, and maintain 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;~~ Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and ~~insurance; and insurance, and shall~~ 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.~~ such Certificate.

§ 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 as required under Article 11 and authorized by public authorities having jurisdiction over the ~~Project.~~ Work. 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.~~ 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.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and ~~acceptance and upon receipt of a final Application for Payment, acceptance,~~ the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, and the Owner agrees that all closeout requirements have been fulfilled, 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 terms and conditions of 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~~ 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, effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner.~~ (3) a written statement that the Contractor knows of no substantial 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) ~~payment and (5), if~~ required by the Owner, other data establishing payment or satisfaction of obligations, such as ~~receipts and receipts,~~ releases and waivers of liens, claims, security ~~interests,~~ 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. Prior to final payment, the Contractor shall submit in triplicate (one (1) original and two (2) copies) to the Architect the following completed forms:~~

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
2. Contractor's Affidavit of Release of Liens, AIA Document G706A
3. Consent of Surety to Final Payment, AIA Document G707.
4. General Contractor's Guarantee - notarized
5. Subcontractor's Warranties from each Subcontractor on Final Subcontractor List
6. All Subcontractors and suppliers and also any other parties that had submitted claims of non-payment shall submit Conditional Lien Releases – notarized. Executed document shall be dated within thirty (30) days of submission of final pay application.
7. Each Offeror (and Subcontractor and supplier submitting a proposal to an Offeror) shall submit a notarized affidavit stating that no asbestos, PCB or lead containing building materials were used on Owner's form.
8. Maintenance, inspection and warranty manuals. Two (2) sets of each bound in a 3-inch "D-slant" ring binder.
9. Record drawings. See Section 3.20.
10. Final Subcontractor List.
11. Refer to Specification Section 01 77 00, Guarantees, Certificates and Project Closeout for any additional information and requirements.
12. Executed TEA Project Compliance Certificate Form (Form 'AL').
13. Executed project Close-Out Form (Form 'AO'), and any additional provisions stated on Form 'AO' as being the responsibility of Contractor.

Documents identified as affidavit must be notarized. All documents requiring signatures must have original signatures (no stamps), and must indicate printed name of signer. All manuals will contain an index listing the information submitted. The index sections will be divided and identified by tabbing each section as listed in the index.

All Manufacturers' warranties must be on manufacturer's original form, indicating project name, and length of warranty.

The Owner may accept certain portions of the work as being complete prior to the acceptance of the entire project. If certain areas are accepted by the Owner as being complete, and if the Contractor has completed all

of the requirements for final payment of that portion of work, the Owner may release retainage for that area/portion of work. Amounts of retainage shall be agreed upon by both Owner and Contractor prior to final acceptance of these areas.

Refer to Project Manual for additional requirements.

§ 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. 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 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 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.

§ 9.10.5 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. 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; or
- .3 — terms of special warranties required by the Contract Documents.

§ 9.10.6 Acceptance of final payment by the Contractor, a Subcontractor or material 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.

§ 10.1.1 Contractor's employees, agents, and Subcontractors and Sub-subcontractors shall not perform any service under this Contract while under the influence of alcohol or any controlled substance. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell illicit or unprescribed controlled drugs or drug paraphernalia, or misuse legitimate prescription drugs while performing the Work. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell alcoholic beverages while performing the Work.

§ 10.1.2 Contractor has adopted or will adopt its own policy to assure a drug and alcohol-free workplace while performing the Work. Contractor will remove any of its employees from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such employee, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. Owner has the right to require Contractor to remove employees from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, Contractor's employees may only be considered for return to work after the Contractor certifies as a result of a for-cause test, conducted immediately following removal that said employee was in compliance with this Contract. Contractor will not use an employee to perform the Work who either refuses to take, or tests positive in any alcohol or drug test.

§ 10.1.3 Contractor will comply with all applicable federal, state, and local drug and alcohol related laws and regulations (e.g., Department of Transportation regulations, Department of Defense Drug-free Work-free Workforce

Policy, Drug-Free Workplace Act of 1988). Owner has also banned the presence of all weapons on the Project Site, whether or not the owner thereof has a permit for a concealed weapon.

§ 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;
- .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, 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; hazards~~, promulgating safety ~~regulations; regulations~~ and notifying ~~the~~ owners and users of adjacent sites and ~~utilities of the safeguards; utilities.~~

§ 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. When use or storage of explosives or other Hazardous Substances (as hereinafter defined) or equipment or unusual construction methods are necessary, the Contractor shall give the Owner reasonable advance notice of the presence or use of such materials, equipment, or methods. Contractor shall be responsible for any Hazardous Substances Contractor or Contractor's employees, contractors, consultants, subcontractors, sub-subcontractors, materialmen, and suppliers use, store, or otherwise introduce to the Premises.

§ 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 Sections 10.2.1.2 and 10.2.1.3, except damage or loss~~ 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; 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.~~

§ 10.2.8 The Contractor shall be responsible for taking all precautions necessary to protect the work in place from any weather conditions including without limitations to flooding, freezing, high winds, tropical storms, hurricanes, etc. 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 such weather conditions.

§ 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, 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, 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-report the condition to~~ the Owner and Architect ~~of the condition in writing.~~

§ 10.3.2 ~~Upon receipt of the Contractor's notice, If requested in writing by the Contractor,~~ 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, verify that it has been rendered harmless. If requested in writing by the Contractor or Architect,~~ 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 such~~ material or substance or who are to perform the task of removal or safe containment of ~~the such~~ 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 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.~~

§ 10.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.

§ 10.5 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 Section 4.3.7.

§ 10.6 Asbestos, Lead or PCBs Containing Materials

§ 10.6.1 The contractor and each subcontractor, sub-subcontractor and suppliers prior to final payment, shall submit an original notarized statement on their letterhead certifying "to the best of their information, knowledge, and belief asbestos-, lead-, and PCB-containing materials, and have not been used or incorporated into the Work and lead or lead-bearing materials have not been incorporated into potable water systems." For the purpose of definition as used in this statement, the term "potable water systems" includes, but is not limited to, those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibs, as applicable to the project.

§ 10.6.2 To the best knowledge of the Owner, the Architect and his consultants, no products or materials containing asbestos or polychlorinated biphenyl (PCB) or other toxic substances have been specified for this project. No products or materials containing asbestos or PCB are to be incorporated in this project. In the event the Contractor or his Sub-contractors become aware that any products or materials specified, ordered, scheduled for or already incorporated in the work on this project, contain asbestos, or PCB, the situation shall be reported immediately to the Owner and Architect in writing. An acceptable, equal substitute for the product or material in question shall be proposed by the Contractor and the product or material in question, if already onsite or incorporated in the work, shall be removed from the site immediately and returned to the supplier or manufacturer.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability 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.

§ 11.1.1 Refer to Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management. The Contractor and Contractor's Subcontractors shall purchase and maintain, in a company or companies licensed and admitted by the Texas Department of Insurance to engage in the business of furnishing insurance in the State of Texas, the types and amounts of insurance as set forth in Section BD of the Agreement to protect it and the Owner from claims that may arise out of, or result from, the Contractor's operations under the Contract, whether such operations be by itself, or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. All insurance companies shall have an "A-VIII" in Best's Rating Guide and shall be satisfactory to the Owner. No Work will be commenced until all requirements of this Article have been approved by the Owner in writing.

§ 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. Insurance required by Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until dates specified in Section BD.

§ 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. Original Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section BD – Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor’s information and belief.~~

~~**§ 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 the Contractor of any contractual obligation to provide any required coverage.~~

§ 11.2 Owner’s Insurance

§ 11.2 Owner’s Liability 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; be responsible for purchasing and maintaining the Owner’s usual liability insurance.~~

~~**§ 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 Project Management Protective Liability Insurance

~~**§ 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. Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Section 11.1.

§ 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 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.

§ 11.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Owner requires the Contractor to furnish payment and performance bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or

specifically required in the Contract Documents on the date of execution of the Contract in a total amount equal to 100% of the Contract Sum and in conformity with applicable law. All bonds shall be issued by a surety company licensed, listed, and authorized to issue bonds in the State of Texas by the Texas Department of Insurance. The surety company may be required by the Owner to have a rating of not less than "B" in the latest edition of Best's Insurance Reports, Property-Casualty. The surety company shall provide, if requested, information on bonding capacity, other projects under coverage and shall provide proof to establish adequate financial capacity for the Project. Should the bond amount be in excess of ten percent (10%) of the surety company's capital and surplus, the surety company issuing the bond shall certify that the surety company has acquired reinsurance, in a form and amount acceptable to the Owner, to reinsure the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus with one or more reinsurers who are duly authorized and admitted to do business in Texas and that amount reinsured by a reinsurer does not exceed ten percent (10%) of the reinsurers capital and surplus.

§ 11.4.2 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 permit a copy to be made.

§ 11.4.3 The Contractor shall deliver the required Bonds to the Owner not later than the date of the preconstruction meeting if the Contract has been executed by Owner. All Bonds will be reviewed and approved by the Owner for compliance with the Contract Documents prior to the Contractor mobilizing onsite. Upon Owner approval, the Contractor will be allowed to mobilize onsite.

§ 11.4.4 All bonds shall be originals. The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney. The name, address, and telephone number of a contact person for the Bonding Company shall be provided.

§ 11.4.5 Bonds shall guarantee the faithful performance of all the covenants, stipulations, and agreements of the Contract. Bonds shall be signed by an agent resident in the State of Texas and date of bond shall be the date of execution of the Contract. If at any time during the continuance of the Contract, the surety of the Contractor's bonds becomes insufficient, the Owner shall have the right to require additional and sufficient sureties which the Contractor shall furnish to the satisfaction of the Owner within ten (10) days after notice to do so. In default thereof, all payment or money due to the Contractor may be withheld until Contractor provides additional surety.

§ 11.4.6 It is distinctly understood that no mechanic, contractor, Contractor, materialman, vendor, artisan or laborer, skilled or unskilled, shall have, claim or acquire any lien upon the Project or any of the improvements in the Project, nor upon any of the land upon which the Project is located.

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. costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense.~~ 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; such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.~~

§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after 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, Section 3.5,~~ if, within one (1) 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, Section 9.9.1,~~ or by terms of ~~any an~~ 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 written notice from the Owner to do ~~so, 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, Section 2.4.~~

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

~~**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.~~

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged ~~construction of the Owner or Separate Contractors, construction,~~ whether completed or partially completed, ~~of the Owner or separate contractors~~ 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. § 12.3.1 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. § 13.1.1 The Contract shall be governed by Texas law and mandatory and exclusive venue for any disputes shall be in Harris County, Texas.~~

§ 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, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations~~

contained in the Contract Documents. ~~Except as provided in Section 13.2.2, neither~~ Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such 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~~Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

~~§ 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~~Rights and Remedies

~~§ 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 approvals where building codes or applicable laws or regulations so require. 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.~~

~~§ 13.4.2 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. 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 there under, except as may be specifically agreed in writing.~~

~~§ 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.

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. 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 which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 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 13.5.1, 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 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 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, their Consultants, or Owner's Third Party Consultant services, and expenses shall be at the Contractor's expense.

§ 13.5.4 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.

§ 13.5.5 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.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Commencement of Statutory Limitation Period

§ 13.6.1 As between the Owner and Contractor:

- .1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- .2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- .3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor

under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

§ 13.7 Refer to Specification Sections 01 35 23, 01 35 23.1 and 01 35 23.2 - Special Owner Requirements for additional requirements to be included as part of the Contract.

§ 13.8 The Owner shall have the right to examine, copy and/or audit the books and other records in possession of the Contractor relating to this Contract at any time deemed necessary by the Owner.

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~~ sixty (60) consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work, the Work under direct or indirect contract with the Contractor, 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 promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2, Section 2.2.1.

§ 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, Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work, repeated suspensions, delays, the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3, 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 Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' written 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, properly executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable miscellaneous fees, profit, and damages.

§ 14.1.4 If the Work is stopped for a period of ~~60 consecutive days~~ sixty (60) consecutive Calendar Days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, Contractor or a Subcontractor or their agents or employees or any other persons or entities performing portions of the Work under contract with the Contractor 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 (7) additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3, Section 14.1.3.

§ 14.2 Termination by the Owner for Cause 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.

§ 14.2.1 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards laws, ordinances, or rules and regulations, or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.
- .5 fails to furnish the Owner, upon written request, with assurances satisfactory to the Owner, evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
- .6 engages in serious or repeated worker misconduct in violation of Article 3.3.2;
- .7 engages in conduct that would constitute a violation of state or federal criminal law, including but not limited to, the laws prohibiting certain gifts to public servants, or engages in conduct that would constitute a violation of the Owner's ethics or conflict of interest policies; or
- .8 fails to proceed continuously and diligently with the construction and completion of the Work, except as permitted under 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, above reasons exist, 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 (7) days' written 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 the site and all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to ~~Section 5.4;~~ 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.~~

§ 14.2.3 The parties hereby agree that: 1) if an order for relief is entered on behalf of the Contractor, pursuant to Chapter 11 of the U.S. Bankruptcy Code; 2) if any other similar order is entered under any debtor relief laws; 3) if Contractor makes assignments for the benefit of one or more of its creditors; 4) if a receiver is appointed for the benefit of its creditors; or 5) if a receiver is appointed on account of its insolvency, any such event could impair or frustrate Contractor's performance of the Contract Documents. Accordingly, it is agreed that upon occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest, adequate assurance of future performance in accordance with the terms and conditions of the Contract Documents. Failure to comply with such request within ten (10) days of delivery of the request shall entitle Owner to terminate the Contract and to the accompanying rights set forth in Subparagraphs 14.2.1 through 14.2.6. In all events, pending receipt of adequate assurance of performance and actual performance in accordance with the Contract Documents, Owner shall be entitled to proceed with the Work with Owner's own forces or with other Contractors on a time and material or other appropriate basis, the cost of which will be charged against the Contract Sum.

§ 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. 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.~~

§ 14.2.5 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 Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.2.6 Contractor hereby assigns the 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).

§ 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, delay~~ or interruption ~~under as described in~~ 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 written 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.

§ 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.~~ Contractor shall be entitled to receive payment from the Owner on the same basis provided in Section 14.1.3.

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

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.

ARTICLE 15 LABOR STANDARDS

§ 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.

§ 15.1 PREVAILING WAGE RATES

§ 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 may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.1.1. Contractor, Contractor's Subcontractors and Sub-subcontractors shall pay all workers not less than the general prevailing rate of per diem wages for work of a similar character where the project is located as detailed in the "Minimum Wage Schedule" in section CB of the specifications, or as otherwise provided in the Contract Document. Wages listed are minimum rates only. However, no claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rate provided herein. Texas Government Code § 2258.001 *et seq.*

§ 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.

§ 15.1.2 Contractor shall forfeit, as a penalty to the Owner, \$60 for each laborer, worker, or mechanic, employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract Documents.

§ 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.

§ 15.1.3 Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors.

~~§ 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.

§ 15.1.4 If no prevailing wage rate schedule is made part of the Contract Documents, then the parties shall use the wage rate determined by the U.S. Department of Labor in accordance with the Davis-Bacon Act, 40 U.S.C. § 276a.

~~§ 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 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

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FORM BB

TEXAS STATUTORY PERFORMANCE BOND
(Penalty of this bond must be 100% of contract amount)

Bond No.: _____

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

(hereinafter called the Obligee) in the amount of _____

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day
of _____, _____.

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 25-03-5755-R-RFP

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

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

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

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

Principal (Seal)

Surety Address

By: _____
Signature and Printed Name

Surety Telephone Number

Surety (Seal)

By: _____
Attorney-in-Fact: Signature and Printed Name

FORM BC

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

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

(hereinafter called the Obligee) in the amount of _____

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day
of _____, _____.

2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 25-03-5755-R-RFP

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

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

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

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

Witness: _____ (Seal)
Principal

_____ By: _____
Signature and Printed Name

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact: Signature and Printed Name

Surety Address

Surety Telephone Number

INSURANCE AND BONDS REQUIREMENTS FOR CONTRACTORS AND FACILITY RENTERS

INSURANCE MANAGEMENT

1.0 GENERAL

- A. The District shall require that the following insurance requirements be met on public works contracts:
1. No Work will be commenced until all requirements of this Section have been approved by the District in writing.
 2. The District shall be furnished a Declaration of Insurance evidencing all policies and endorsements required by this Section prior to proceeding with any work.
 3. The insurance shall contain a provision that at least thirty days prior written notice shall be given to the District in the event of cancellation, material change, or non-renewal.
 4. Insurance shall be underwritten by a company rated not less than B+ VII in Best's latest published guide.
 5. There shall be a hold harmless agreement in which the Contractor assumes liability on the contract and holds the School District harmless.
 6. The Contractor shall purchase and maintain in force the following kinds of insurance and bonds for operations under construction contracts and as specified in each section.
 7. No deletions/exclusions from standard coverage form are allowed without the written consent of Cypress-Fairbanks Independent School District.
 8. Furnish copies of subcontractors Certificates of Insurance to Owner.
 9. Furnish copies of Worker Compensation Documents to Owner.

2.0 CASUALTY INSURANCE

- ### A. Worker's Compensation Insurance Coverage

Definitions:

Certificate of coverage (“Certificate”) - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers’ compensation insurance coverage for the person’s or entity’s employees providing services on a project, for the duration of the project.

Duration of the project - includes the time from the beginning of the work on the project until one (1) year after Substantial Completion of the project.

Persons providing services on the project (“subcontractor” in Texas Labor Code 406.096) - includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity that furnishes persons to provide services on the project. “Services” shall include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. “Services” does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

1. The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code 401.011 (44) for all employees of the contractor providing services on the project for the duration of the project.

- 1) a certificate of coverage, prior to the other person beginning work on the project; and

- ## REQUIRED WORKERS' COMPENSATION COVERAGE

“Call the Texas Workers’ Compensation Commission at (512) 440-3789 to receive information on the legal requirements for coverage, to verify whether your employer has provided the required coverage, or to report an employer’s failure to provide coverage.”

Each Occurrence Limit		\$1,000,000 CSL
Products/Completed Operations	Aggregate	\$1,000,000
Personal and Advertising Injury	Occurrence	\$1,000,000
Fire Damage, Legal Liability	Any one fire	\$50,000
Medical Expenses	Any one person	\$5,000

- C. The Owner shall be named as an additional insured by endorsement on the Contractor's policy as to the subject job.

2.1 AUTOMOBILE LIABILITY INSURANCE

- A. Business (Commercial) Automobile Liability Insurance
 1. Coverage for all owned, non-owned and hired vehicles:

Bodily Injury/Property Damage	\$1,000,000 CSL

2.2 UMBRELLA LIABILITY INSURANCE (EXCESS) \$1,000,000

- A. The Owner shall be named as an additional insured on the Contractor's policy as to the subject job.
- B. This policy shall provide coverage over the Workmen's Compensation, Commercial General Liability and Business Automobile Liability policies.

2.3 PROPERTY INSURANCE (BUILDER'S RISK/INSTALLATION FLOATER)

- A. The policy shall be written in the name of the Owner, Contractor, and subcontractors as their interest may appear.
- B. The policy shall be written on an all risk basis for physical loss or damage and include theft, vandalism, malicious mischief.
- C. The amount of coverage shall be for the full insurable value of work.
- D. The deductible shall not be over \$1,000.00 without the approval of the Owner. (Deductible losses shall be paid by the Contractor.)
- E. The policy shall include an endorsement allowing Owner occupancy, and the insurance shall not be canceled or altered on account of partial occupancy prior to completion.
- F. A subrogation clause shall waive subrogation as to the Contractor, subcontractor, sub-subcontractors, the Owner and his employees and representatives.
- G. The original builders risk policy shall be furnished to the Owner prior to start of the job and maintained through Substantial Completion

3.0 BONDS

- A. Bonds are required for public works contracts under the following circumstances:
1. Performance Bond and Labor and Material Payment Bond, each in a personal sum equal to 100% of contract sum if the formal contract is in excess of \$25,000.00.
 2. A Proposal Bond or Proposal Security in the amount of 10% of any proposal of \$25,000.00 or more must be submitted with formal proposals on public works contracts or as otherwise specified in each contract.
 3. Copies of the bonds shall be filed with the county clerk and the owner shall receive a file receipt.
 4. Performance and Payment Bonds shall remain in force for one (1) year after substantial completion.
 5. The Work will not be started until the bonds and issuing companies have been accepted in writing as satisfactory by the Owner.
 6. The original bonds will be delivered to the Owner with an attached authorized power of attorney.

END OF DOCUMENT

SECTION CA
APPLICATION AND CERTIFICATION FOR PAYMENT
CHECK LIST AND TRANSMITTAL

Date: _____ Application for Payment No.: 01818-08-01,
01818-08-02,
01818-08-03,
01818-08-04

Project: 2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements Architect's Proposal Number: 01818-08-04

Owner: Cypress-Fairbanks Independent School District Architect: Huckabee

Contractor: _____

Transmitted herewith is one (1) completed copy of the above referenced Application and Certificate for Payment. By initialing each item listed below, the undersigned certifies that he/she has personally checked and determined that each of the items is in compliance with the requirements of the Contract Documents.

Item	Description	CONTRACTOR Initial to Acknowledge Compliance	ARCHITECT Initial to Acknowledge Compliance	OWNER Initial to Acknowledge Compliance	Notes, Exceptions
A	One (1) complete copy of the above Referenced Application and Certificate for Payment, signed and Notarized, are enclosed.				
B	The grand totals of the Continuation Sheet match the amounts shown on the Application and Certificate for Payment.				
C	Percentage drawn for Supervision and General Conditions is less than or equal to the Continuation Sheet grand total percentage complete.				
D	Unconditional Release for each lien or claim that is applicable to period covered in Previously Approved Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
E	Conditional Release for each lien or claim that is applicable to period covered in Current Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
F	One (1) copy of Stored Materials Inventory List and Invoices enclosed for each line item of stored materials.				
G	One (1) updated Construction Schedule enclosed.				
H	Recovery Plan from GC if project is behind schedule.				
I	Anticipated Weather Delay Log				
J	Construction Progress Photographs enclosed.				
K	Back charges are paid to date (e.g. Operations (Custodial)/Maintenance overtime, badges and retesting.)				

Submitted by (Signature): _____
Name (Printed or Typed): _____

Title: _____

Date: _____

SECTION CB

**SUPPLEMENTARY CONDITIONS TO THE
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AS AMENDED**

Add the following Subparagraph:

1.1.11 DESCRIPTION OF PARTIES

The following definitions apply to parties named in the Contract Documents.

1. Owner: Cypress-Fairbanks Independent School District
 Facilities & Construction Department
 11430-B Perry Road
 Houston, Texas 77064
 Phone: (281) 897-4057
 Representative: Jesse Clayburn, Asst. Superintendent of Facilities & Construction

2. Architect: Huckabee, Inc.
 1700 City Plaza Dr.
 City Place 1, Suite 125
 Spring, Texas 77389
 Phone: (281) 520-4995

3. MEP Salas O'Brien
 Engineer: 738 Highway 6 South, Ste. 615
 Houston, Texas 77079
 Phone: (281) 945-8888

Include additional consultants as needed

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Add the following Subparagraph:

- 2.2.6** The Contractor will be furnished, free of charge, **one (1) set** sets of drawings, specifications, and addenda, for pickup by the Contractor from the office of the Architect.

15.1 PREVAILING WAGE RATES

- 15.1.3** Prevailing Wage Rate Determination Information follows on the *next page*.

15.1 PREVAILING WAGE RATES

Prevailing Wage Rate Determination Information

The following information is from Chapter 2258 Texas Government Code:

Sec. 2258.021. Right to be Paid Prevailing Wage Rates.

- (a) *A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:*
 - (1) *not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and*
 - (2) *not less than the general prevailing rate of per diem wages for legal holiday and overtime work.*
- (b) *Subsection (a) does not apply to maintenance work.*
- (c) *A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.*

Sec. 2258.023. Prevailing Wage Rates to be paid by Contractor and Subcontractor; Penalty.

- (a) *The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section [2258.022](#) to a worker employed by it in the execution of the contract.*
- (b) *A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.*
- (c) *A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section [2258.022](#).*
- (d) *The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.*
- (e) *A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.*

Sec. 2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

- (1) *take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and*
- (2) *withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.*

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

Prevailing Wage Rates
Worker Classification Definition Sheet

CLASSIFICATION	DEFINITION
ASBESTOS WORKER	Worker who removes and disposes of asbestos materials.
BRICKLAYER; MASON	Craftsman who works with masonry products, stone, brick, block, or any material substituting those materials and accessories.
CARPENTER; CASEWORKER	Worker who build wood structures or structures of any material which has replaces wood. Includes rough and finish carpentry, hardware and trim.
CARPET LAYER; FLOOR INSTALLER	Worker who installs carpets and /or floor coverings, vinyl tile.
CONCRETE FINISHER	Worker who floats, trowels, and finishes concrete.
DATA COMM/TELE COMM	Worker who installs data/telephone and television cable and associate equipment and accessories.
DRYWALL; CEILING INSTALLER	Worker who installs metal framed walls and ceiling, drywall coverings, ceiling grids, and ceilings.
ELECTRICIAN	Skilled craftsman who installs or repairs electrical wiring and devices. Includes fire alarm systems and HVAC electrical controls.
ELEVATOR MECHANIC	Craftsman skilled in the installation and maintenance of elevators.
FIREPROOFING INSTALLER	Worker who sprays or applies fire proofing materials.
GLAZIER	Worker who installs glass, glazing, and glass framing.
HEAVY EQUIPMENT OPERATOR	Includes but not limited to: all CAT tractors, all derrick-powered, all power operated cranes, back-hoes, back-fillers, power operated shovels, winch trucks, and all trenching machines.
INSULATOR	Worker who applies, sprays, or installs insulation.
IRONWORKER	Skilled craftsman who erects structural steel framing, and installs structural concrete Rebar.
LABORER, HELPER	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials or tools, hauling, digging, clean up.
LATHERER; PLASTERER	Worker who installs metal framing and lath. Worker who applies plaster to lathing and installs associated accessories.
LIGHT EQUIPMENT OPERATOR	Includes but not limited to , air compressors, truck crane drivers, flex planes, building elevators, form graders, concrete mixers less than 14cf), conveyers.
METAL BUILDING ASSEMBLER	Worker who assembles pre-made metal buildings.
PAINTER; WALL COVERING INSTALLER	Worker who prepares wall surfaces and applies paint and/or wall coverings, tape, and bedding.
PIPEFITTER	Trained worker who installs piping systems, chilled water piping and hot water (boiler) piping, pneumatic tubing controls, chillers, boilers, and associated mechanical equipment.
PLUMBER	Skilled craftsman who installs domestic hot and cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
ROOFER	Worker who installs roofing materials, Bitumen (asphalt and coal tar) felts, flashings, all types of roofing membranes, and associated products.
SHEET METAL WORKER	Worker who installs sheet metal products, Roof metal, flashings and curbs, ductwork, mechanical equipment, and associated metals.
SPRINKLER FITTER	Worker who installs fire sprinklers systems and fire protectant equipment.
STEEL ERECTOR	Worker who erects and dismantles structural steel frames of buildings and other structures.
TERRAZZO WORKER	Craftsman who places and finishes Terrazzo
TILE SETTER	Worker who prepares wall and/or floor surfaces and applies ceramic tiles to these surfaces.
WATERPROOFER; CAULKER	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membranes, and liquid membranes, sprayed, rolled or brushed.

END OF DOCUMENT

Section CC

Right of Audit - Examination of Records

1. Records for all contracts, specifically including but not limited to lump sum contracts (i.e. fixed price or stipulated sum contracts), unit price, cost plus or time & material contracts with or without a guaranteed maximum (or not-to-exceed amounts) shall upon reasonable notice be open to inspection and subject to audit, scanning, and/or reproduction during normal business working hours. Such audits may be performed by any Owner's representative, or any outside representative engaged by Owner for the purpose of examining such records. The Owner or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law. Owner's representatives may (without limitation) conduct verifications such as counting employees at the Construction Site, witnessing the distribution of payroll, verifying information and amounts through interviews and written confirmations with Contractor employees, field and agency labor, subcontractors, and vendors.
2. Contractor's "records" as referred to in this Exhibit shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in Owner's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records shall include (hard copy, as well as computer readable data if it can be made available), written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, negotiation notes, etc.); original bid estimates; estimating work sheets; correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; invoices and related payment documentation; general ledger, information detailing cash and trade discounts earned, insurance rebates and dividends; and any other contractor records which may have a bearing on matters of interest to the Owner in connection with the contractor's dealings with the Owner (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of any or all of the following:
 - a) Compliance with contract requirements for deliverables
 - b) Compliance with approved plans and specifications
 - c) Compliance with Owner's business ethics expectations
 - d) Compliance with contract provisions regarding the pricing of change orders
 - e) Accuracy of contractor representations regarding the pricing of invoices
 - f) Accuracy of contractor representations related to claims submitted by the contractor or any of his payees.
3. Contractor shall require all payees (examples of payees include subcontractors, material suppliers, insurance carriers, etc.) to comply with the provisions of this article by including the requirements hereof in a written contract agreement between Contractor and payee. Contractor will ensure that all payees (including those entering into lump sum contracts) have the same right to audit provisions contained in this contract.
4. Owner's authorized representative(s) shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this contract and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with this article.
5. If an audit inspection or examination in accordance with this article, discloses overpricing or overcharges to the Owner (of any nature) by the Contractor and/or the Contractor's Subcontractors in excess of \$100,000 in addition to making adjustments for the overcharges, the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of Owner's findings to Contractor.

Section CC

Right of Audit – Records to Be Provided to Owner’s Representatives Upon Request

In addition, to the normal paperwork documentation the Contractor typically furnishes to the Owner, in order to facilitate efficient use of Owner resources when reviewing and/or auditing the Contractor’s billings and related reimbursable cost records, the Contractor agrees to furnish (upon request) the following types of information in the specified computer (PC) readable file format(s):

Type of Record	PC Readable File Format
Monthly Job Cost Detail	.pdf and Excel
Detailed job Cost History To Date	.pdf and Excel
Monthly Labor Distribution detail (if not already separately detailed in the Job Cost Detail)	.pdf and Excel
Total Job to date Labor Distrubution detail (if not already included in the detailed Job Cost History to date)	.pdf and Excel
Employee Timesheets documenting time worked by all individuals who charge reimbursable time to the project	.pdf
Daily Foreman Reports listing names and hours and tasks of personnel who worked on the project	.pdf
Daily Superintendent Reports	.pdf
Detailed Subcontract Status Reports (showing original subcontract value, approved subcontract change orders, subcontractor invoices, payment to subcontractors, etc.	.pdf and Excel
Copies of Executed Subcontracts with all Subcontractors	.pdf
Copies of all executed change orders issued to Subcontractors	.pdf
Copies of all documentation supporting all reimbursable job costs (subcontractor payment applications, vendor invoices, internal cost charges, etc.)	.pdf

SUMMARY OF WORK

PART 1 - GENERAL

A. Project, **2025 Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC Chiller Replacements**, with campus locations at the following addresses:

- for the Cypress-Fairbanks Independent School District.

- ### C. Project Schedule:

- A. Contractor Use of Premises:

- 01 10 00 - 1

5. Contractor shall establish secured staging area for work and coordinate and provide for safe passage and exit from existing building areas during construction, in compliance with all applicable codes and requirements of Owner.
 6. During phased construction, Contractor shall provide maps of building to Owner for each phase, showing construction area and impact to other areas of the building.
 7. Contractor shall coordinate all construction activities with school district officials.
 8. Owner reserves the right to perform construction operations with its own forces or to employ separate contractors on portions of the Project. General Contractor shall coordinate with Owner-performed work in terms of providing site access, workspace, and storage space, cooperation of work forces, scheduling, and technical requirements.
 9. Noise Control: Contractor shall coordinate equipment locations and timing of work activities so as to avoid conflict with the building occupants and/or avoid interference with facility meetings, events, or other activities.
 10. Utilities. The contractor is to coordinate all utilities permanent and temporary and make arrangements for installation for any service easements once the Owner provides information that a blanket or final easement exists.
 11. Project Fencing:
 - a. Upon mobilization, the contractor shall build a wire mesh fence (or other type) as directed by Owner, at least six (6) feet high as shown on site plan and/or discussed during the pre-construction meeting.
 - b. Site fencing shall include emergency service and trucking gated in locations shown on the site plan and/or discussed during the pre-construction meeting.
 - c. Contractor shall properly maintain fencing and gates until Substantial Completion and only remove with concurrence from the Owner.
- B. Owner Occupancy:
1. Refer to AIA Document A201™–2017, as amended.
- C. Owner-Furnished/Owner-Installed Items:
1. The Owner reserves the right to place and install equipment in construction areas of the building prior to Substantial Completion, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment shall not constitute acceptance of the total Work. Contractor shall protect Owner's property.
- D. Owner-Furnished/Contractor-Installed Items:
1. The Owner may provide items to the Contractor for installation in accordance with manufacturer's recommendation and instructions.
 2. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage.
 3. If Owner-furnished items are damaged, defective or missing, through no fault of the Contractor, the Owner will arrange for replacement.
 4. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to elements, and to repair or replace items damaged as a result of his operations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Specification Sections.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. GENERAL DESCRIPTION OF WORK TO BE PERFORMED UNDER THIS CONTRACT

The Work to be performed under this contract shall commence on Notice to Proceed and shall be Substantially Complete as stipulated by AIA Document A101™-2017, as amended.

B. GENERAL CONSTRUCTION PHASING REFERENCING CFISD NEEDS BELOW, SHALL BE INCORPORATED INTO THE CONTRACT, INCLUDING BUT NOT LIMITED TO:

Campbell MS

The existing chilled water plant consists of (2) water cooled chillers, 250 tons each and (1) 191-ton air cooled chiller.

The project scope at Campbell MS includes replacement of (1) 250 ton water cooled chillers. The remaining operating plant capacity is 441 tons and has shown to deliver adequate cooling to the building to maintain the district's standard temperature and humidity setpoints of 75°F and 50-55% RH.

In addition, the project also includes replacing the (1) condenser water pump associated with chiller being replaced, adding main supply and return chilled water manual shut off valves and adding supply and return piping taps with valves and flanges for temporary chiller connections should the district need them in the future. Refer to the drawings for additional scope included in the project.

The chilled water plant, excluding the chiller being replaced, shall remain in **FULL** operation throughout the entire duration of the project and maintain the district's cooling and dehumidification setpoints (listed above) in the entire campus.

If a plant shutdown is required to execute any portion of the project scope, the shutdown of the plant at this campus is restricted to periods of time when the building is UNOCCUPIED in its entirety. Refer to the district's academic calendar. Shutdowns shall be coordinated, scheduled, and accepted by the Owner, Architect, and Engineer a minimum of 1 week prior to the plant being disabled.

During any plant shutdown greater than 8 hours in duration , the contractor shall provide and install temporary cooling and dehumidification equipment to maintain 80°F and 60% RH in the following locations:

1. Library
2. Competition Gymnasium
3. Auxiliary Gymnasium
4. Locker Rooms
5. Band
6. Choir
7. Orchestra FU
8. Administration (Complete Suite)
9. Science Classroom (Each)

In addition, during periods of time when the plant is shut down and utilizing temporary cooling and dehumidification equipment, the contractor shall monitor and log building temperature and humidity every 2 hours for each location listed. Digital logs shall be provided to Owner, Architect and Engineer upon completion of each scheduled plant shut for review and acceptance.

Jersey Village HS

The existing chilled water plant consists of (3) water cooled chillers, (2) 650 ton machines and (1) 211 ton machine.

The project scope at Jersey Village HS includes the replacement of all (3) water cooled chillers. In addition, the project scope includes replacing the (3) condenser water pumps, (3) primary chilled water pumps, adding main supply and return chilled water manual shut off valves and adding supply and return piping taps with valves and flanges for temporary chiller connections for the use with the rental chillers and for future use should the district need them. Refer to the drawings for additional scope included in the project.

The campus will be occupied and fully utilized throughout the chiller replacement project. Therefore, the project shall include rental air cooled chillers, temporary pumps, temporary hoses with means to manifold piping into a single tap in central plant, temporary electrical wiring, any other equipment, and components required to deliver a fully functioning temporary chilled water plant including installation of all rental equipment. The rental equipment shall have a minimum delivered capacity of **1,500 tons** to ensure the entire building is maintained at the district's standard temperature and humidity setpoints of 75°F and 50-55% RH.

The first phase of the chiller replacement project shall include the installation of the main supply and return chilled water manual shut off valves and the installation of the chilled water supply and return piping taps with valves and flanges for temporary chiller connections.

The second phase of the chiller replacement project shall include the installation of all rental chilled water equipment. The existing chilled water equipment shall NOT be disconnected or removed prior to demonstrating the rental chilled water equipment is functioning and capable of maintaining building setpoints for a period of 48 hours. Upon completion of the 48 hour demonstration period the contractor shall request acceptance of the rental chilled water plant's performance from the Owner, Architect and Engineer prior to proceeding with replacing any of the existing equipment. Any of the existing chilled water equipment shall not be removed prior to receiving the new chilled water equipment at the job site. Location of the rental chilled water equipment shall be reviewed and approved by the owner prior to installation.

The third phase of the chiller replacement project shall include the installation of new chilled water system equipment.

The fourth phase of the chiller replacement project shall include a demonstration that the new chilled water equipment is functioning and capable of maintaining the building setpoints for a period of a one (1) week. Upon completion of the one (1) week demonstration period the contractor shall request acceptance of the new chilled water equipment's performance from the Owner, Architect and Engineer prior to proceeding to the next phase.

The last phase of the chiller replacement project shall include the removal of rental chilled water equipment from the site.

If a plant shutdown is required to prepare for rental chiller connection to the building and its operation or to execute any portion of the project scope, the shutdown of the plant at this campus is restricted to periods of time when the building is UNOCCUPIED in its entirety. Shutdowns shall be coordinated, scheduled, and accepted by the Owner, Architect, and Engineer a minimum of 1 week prior to the plant being disabled.

During any plant shutdown greater than 8 hours in duration, the contractor shall provide and install temporary cooling and dehumidification equipment to maintain 80°F and 60% RH in the following locations:

1. Library
2. Competition Gymnasium
3. Auxiliary Gymnasium

4. Locker Rooms
5. Band
6. Choir
7. Orchestra
8. Administration (Complete Suite)
9. Science Classroom (Each)

In addition, during periods of time when the plant is shut down and utilizing temporary cooling and dehumidification equipment, the contractor shall monitor and log building temperature and humidity every 2 hours for each location listed. Digital logs shall be provided to Owner, Architect and Engineer upon completion of each scheduled plant shut for review and acceptance.

Berry Center

The existing chilled water plant consists of (3) water cooled chillers, (2) 525 ton machines and (1) 375 ton machine.

The project scope at the Berry Center includes the replacement of all (3) water cooled chillers. In addition, the project scope includes replacing the (3) primary chilled water pumps, adding main supply and return chilled water manual shut off valves and adding supply and return piping taps with valves and flanges for temporary chiller connections for the use with the rental chillers and for future use should the district need them. Refer to the drawings for additional scope included in the project.

The facility will be occupied and fully utilized throughout the chiller replacement project. Therefore, the project shall include rental air cooled chillers, temporary pumps, temporary hoses with means to manifold piping into a single tap in central plant, temporary electrical wiring, any other equipment, and components required to deliver a fully functioning temporary chilled water plant including installation of all rental equipment. The rental equipment shall have a minimum delivered capacity of **1,500 tons** to ensure the entire building is maintained at the district's standard temperature and humidity setpoints of 75°F and 50-55% RH.

The first phase of the chiller replacement project shall include the installation of the main supply and return chilled water manual shut off valves and the installation of the chilled water supply and return piping taps with valves and flanges for temporary chiller connections. In addition, this phase shall include removal and reinstallation of new refrigerant lines associated with existing cooler and freezer system.

The second phase of the chiller replacement project shall include the installation of all rental chilled water equipment. The existing chilled water equipment shall NOT be disconnected or removed prior to demonstrating the rental chilled water equipment is functioning and capable of maintaining building setpoints for a period of 48 hours. Upon completion of the 48 hour demonstration period the contractor shall request acceptance of the rental chilled water plant's performance from the Owner, Architect and Engineer prior to proceeding with replacing any of the existing equipment. Any of the existing chilled water equipment shall not be removed prior to receiving the new chilled water equipment at the job site. Location of the rental chilled water equipment shall be reviewed and approved by the owner prior to installation.

The third phase of the chiller replacement project shall include the installation of new chilled water system equipment.

The fourth phase of the chiller replacement project shall include a demonstration that the new chilled water equipment is functioning and capable of maintaining the building setpoints for a period of a one (1) week. Upon completion of the one (1) week demonstration period the contractor shall request acceptance of the new chilled water equipment's performance from the Owner, Architect and Engineer prior to proceeding to the next phase.

The last phase of the chiller replacement project shall include the removal of rental chilled water equipment from the site.

If a plant shutdown is required to prepare for rental chiller connection to the building and its operation or to execute any portion of the project scope, the shutdown of the plant at this campus is restricted to periods of time when the building is UNOCCUPIED in its entirety. Refer to the district's academic calendar. Shutdowns shall be coordinated, scheduled, and accepted by the Owner, Architect, and Engineer a minimum of 1 week prior to the plant being disabled.

During any plant shutdown greater than 8 hours in duration, the contractor shall provide and install temporary cooling and dehumidification equipment to maintain 80°F and 60% RH in the 5 locations to be coordinate with campus leadership and food service.

In addition, during periods of time when the plant is shut down and utilizing temporary cooling and dehumidification equipment, the contractor shall monitor and log building temperature and humidity every 2 hours for each location listed. Digital logs shall be provided to Owner, Architect and Engineer upon completion of each scheduled plant shut for review and acceptance.

Cy Ranch HS

The existing chilled water plant consists of (4) water cooled chillers, (3) 1,100 ton machines and (1) 300 ton machine. Currently two of the 1,100 water cooled chillers are not operational, CH-1 and CH-3. While the connected campuses are functioning on the reduced capacity of 1,400 tons, the existing chilled water system struggles at times to maintain supply water temperature. The existing chilled water central plant supplies cooling to Cy Ranch H.S., Smith M.S. and Warner E.S.

The project scope at the Cy Ranch HS Central Plant includes the replacement of all (4) water cooled chillers. In addition, the project scope includes replacing the (4) primary chilled water pumps, (3) vertical turbine condenser water pumps, adding main supply and return chilled water manual shut off valves and adding supply and return piping taps with valves and flanges for temporary chiller connections for the use with the rental chillers and for future use should the district need them. Refer to the drawings for additional scope included in the project.

The (3) campuses connected to this chilled water central plant will be occupied and fully utilized throughout the chiller replacement project. Therefore, the project shall include rental air cooled chillers, temporary pumps, temporary hoses with means to manifold piping into a single tap in central plant, temporary electrical wiring, any other equipment, and components required to deliver a fully functioning temporary chilled water plant including installation of all rental equipment. The rental equipment shall have a minimum delivered capacity of **1,500 tons** to ensure the all facilities connected to this plant are maintained at the district's standard temperature and humidity setpoints of 75°F and 50-55% RH.

The first phase of the chiller replacement project shall include the installation of the main supply and return chilled water manual shut off valves and the installation of the chilled water supply and return piping taps with valves and flanges for temporary chiller connections.

The second phase of the chiller replacement project shall include the installation of all rental chilled water equipment. The existing chilled water equipment shall NOT be disconnected or removed prior to demonstrating the rental chilled water equipment is functioning and capable of maintaining building setpoints for a period of 48 hours. Upon completion of the 48 hour demonstration period the contractor shall request acceptance of the rental chilled water plant's performance from the Owner, Architect and Engineer prior to proceeding with replacing any of the existing equipment. Any of the existing chilled water equipment shall not be removed prior to receiving the new

chilled water equipment at the job site. Location of the rental chilled water equipment shall be reviewed and approved by the owner prior to installation.

The third phase of the chiller replacement project shall include the installation of the new CH-1 and CH-3 and associated primary pumps. In addition, this phase shall include the replacement of the (3) condenser water pumps. Upon completion of the installation of all equipment in this phase, the new chillers CH-1 and CH-3 shall be put in service to deliver additional cooling capacity to the (3) connected campuses. The rental chilled water equipment shall remain connected and in use.

The fourth phase of the chiller replacement project shall include the installation of the new CH-2 and CH-4 and associated primary pumps.

The fifth phase of the chiller replacement project shall include a demonstration that all the new chilled water equipment is functioning and capable of maintaining the building setpoints for a period of one (1) week. Upon completion of the one (1) week demonstration period the contractor shall request acceptance of the new chilled water equipment's performance from the Owner, Architect and Engineer prior to proceeding to the next phase.

The last phase of the chiller replacement project shall include the removal of rental chilled water equipment from the site.

If a plant shutdown is required to prepare for rental chiller connection to the building and its operation or to execute any portion of the project scope, the shutdown of the plant at this campus is restricted to periods of time when the building is UNOCCUPIED in its entirety. Shutdowns shall be coordinated, scheduled, and accepted by the Owner, Architect, and Engineer a minimum of 1 week prior to the plant being disabled.

During any plant shutdown greater than 8 hours in duration, the contractor shall provide and install temporary cooling and dehumidification equipment to maintain 80°F and 60% RH at Cy Ranch H.S., Smith M.S. and Warner E.S. in the following locations:

1. Library
2. Competition Gymnasium
3. Auxiliary Gymnasium
4. Locker Rooms
5. Band
6. Choir
7. Orchestra
8. Administration (Complete Suite)
9. Science Classroom (Each)

In addition, during periods of time when the plant is shut down and utilizing temporary cooling and dehumidification equipment, the contractor shall monitor and log building temperature and humidity every 2 hours for each location listed. Digital logs shall be provided to Owner, Architect and Engineer upon completion of each scheduled plant shut for review and acceptance.

END OF SECTION

SECTION 01 11 23

CODES, REGULATIONS AND STANDARDS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality Assurance
- B. References Standards
- C. Definitions
- D. Format and Specification Context Explanations
- E. Abbreviations
- F. Drawing Symbols
- G. General Requirements

1.2 QUALITY ASSURANCE

- A. General:
 - 1. For products or Workmanship specified by a standard of an association, trade, or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code authorities having jurisdiction.
 - 2. The contractual relationship of the parties to the Contract should not be altered from the Contract Documents by mention or inference otherwise in any reference standard.
 - 3. Obtain copies of standards when required by Contract Documents.
 - 4. Maintain copy of standards at jobsite during submittals, planning, and progress of the specific Work for which the standards pertain, until the date of Substantial Completion.
 - 5. In the absence of specific instructions in the specifications, materials, products, equipment and their installation shall conform to the applicable codes, regulations and standards specified therein. When a conflict exists between the applicable code, regulation and standard and that specified, the more stringent code regulation or standard shall prevail, except as authorized by applicable authorities having jurisdiction.
- B. Industry Standards: Where compliance with two (2) or more industry standards or sets of requirements is specified and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer questions to the Architect for a decision before proceeding.
- C. Contractor's Option: Except for overlapping or conflicting requirements, where more than one (1) set of requirements are specified for a particular unit of Work, the option shall be Contractor's regardless of whether or not it is specifically indicated as such.
- D. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended to be the minimum for the Work to be performed or provided. Except as otherwise specifically indicated, the actual Work shall either comply exactly with the minimum (within specified

tolerances). In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect for decision before proceeding.

- E. Specialists; Assignments: In certain instances, specification text requires (or implies) that specific Work is to be assigned to specialists. Such Work shall be accomplished by the specified specialist. These requirements should not be interpreted so as to conflict with applicable regulations, union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as “expert” for the indicated construction processes or operations. Notwithstanding any such designation, the final responsibility for fulfillment of all Contract requirements remains with the Contractor.

1.3 REFERENCE STANDARDS

- A. Dates of codes, regulations and standards specified shall be the latest date of issue of that code, regulation or standard prior to the date of issue of this Project Manual or Document, except as modified or otherwise directed by the applicable codes and their supplements and amendments adopted by the code authorities having jurisdiction.
 - 1. Date of Issue - The “date of issue” as it appears in the statement above, means the date which appears on the cover of the Project Manual or Document corresponding to the date of issue of the Contract Documents.
 - 2. Code Authorities: The “code authorities” as it appears in the statement above, means the International Building Code (IBC) with City of Houston Amendments, Harris County Regulations, and those authorities responsible for code enforcement.

1.4 DEFINITIONS

- A. General Explanation: A substantial amount of specification language consists of definitions for terms found in other Contract Documents, including those in the AIA A201 General Conditions of the Contract for Construction as amended, Supplementary Conditions, the Drawings, and the Specifications. Drawings must be recognized as being diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in the Contract Documents are defined in the General Conditions, Supplementary Conditions, and in this Section. Definitions and explanations contained in this Section are not necessarily either complete or exclusive but are general for this Work to the extent that they are not stated more explicitly in another element of the Contract Documents. In the event of a conflict in definitions or explanations within the Contract Documents or whenever there is need of clarification or interpretation of definitions within or between the Contract Documents, notify the Architect immediately and proceed as directed. Except in cases where definitions are determined by code authorities having jurisdiction, the Architect’s interpretation of all definitions will take precedence.
- B. General Requirements: The provisions or requirements of Division 1 - Sections apply to entire Work of Contract and, where indicated, to other elements which are included in the Project.
- C. Special Conditions: Wherever the term “Special Conditions”, appears in the Contract Documents, it refers collectively to all requirements of the Owner in addition to the sections in Division 1, General Requirements, and to Articles contained in the General Conditions and Supplementary Conditions.
- D. Architect: Wherever the term “Architect” appears in the Contract Documents, it means Huckabee Architects or their authorized representative(s).
- E. Bid, Competitive Sealed Proposal (CSP), Response, Offer, etc.: Wherever the term “Bid”, “Competitive Sealed Proposal (CSP)”, “Response”, “Offer”, “Proposal”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean

Competitive Sealed Proposal, which by definition allows the Owner to accept the “best value” for the school district based on factors other than cost in selecting the Contractor.

- F. Contractor, General Contractor, etc.: Wherever the term “Contractor”, “General Contractor”, “Prime Contractor”, “Bidder”, “Bidder/Vendor”, “Vendor”, “Installer”, “Integrator”, “Subcontractor”, “Respondent”, “Offeror”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall refer to the entity (person or firm) licensed and meeting all applicable regulations of the State of Texas and Department of Labor to perform the Work, or their authorized representative(s).
1. Responsibilities: To avoid any misunderstanding or lack of interpretation, the responsibility for performing the Work is totally that of the entity defined above, and the resolutions proposed in his shop drawings and related documentation shall be demonstrated throughout the Work and specified warranty period.
 2. In the event of a controversy involving the Contract Documents or interpretation of Project requirements, the decision of the Architect will take precedence.
- G. Consultant: Wherever the term “Consultant”, or any derivative thereof appears in the Contract Documents, it means the following:
1. Owner's Consultants:
 - a. Third Party Plan Reviewer: Winning Way
 - b. Materials Testing: TBD
 - c. Roof Inspection: TBD
 - d. Mechanical Testing and Balancing: TBD
 - e. Commissioning: TBD
 2. Architect's Consultants:
 - a. Civil Engineer: TBD
 - b. Structural Engineer: IEG
 - c. MEP Engineer: Salas O'Brien
 - d. Landscape Consultant: TBD
 - e. Roofing Consultant: TBD
 - f. Food Service Consultant: TBD
 - g. Asbestos Abatement Consultant: EFI Global, Inc.
 - h. Geotechnical Engineer: TBD
 - i. Traffic Engineer: TBD
 - j. Acoustical Engineer: TBD
- H. Indicated: Wherever the term “indicated”, or any derivative thereof appears in the Contract Documents, it means a cross-reference to graphic representations, notes, or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in the Contract Documents. Where terms such as “shown”, “noted”, “scheduled”, and “specified” are used in lieu of “indicated”, it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
- I. Directed, Requested, Etc.: Where not otherwise explained, terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, “accepted”, and “permitted” or any derivative thereof appears in the Contract Documents, it means as “directed by the Architect”, “requested by the Architect”, and similar phrases with actions taken by the Architect. However, no meaning or otherwise shall be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- J. Approve: Wherever the term “Approve”, or any derivative thereof appears in the Contract Documents, it means only the Architect, or an individual designated by him as his representative, can approve or disapprove contract actions. Even if the specifications indicate that an individual other than the Architect, such as the “Engineer” or “Consultant” will approve or disapprove an

action, it is understood that only the Architect has this authority unless the individual is so designated by him in writing. Even when an individual is so designated, the Contractor may appeal the action to the Architect and the Architect's decision will be final. In no case will "approval" by the Architect be interpreted as a release of the Contractor from responsibility to fulfill requirements of the Contract Documents.

- K. Furnish: Wherever the term "Furnish", or any derivative thereof appears in the Contract Documents, it means supply or deliver to Project site, ready for unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- L. Install: Wherever the term "Install", or any derivative thereof appears in the Contract Documents, it means performing the operations at the Project site, of unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- M. Provide: Wherever the term "Provide", or any derivative thereof appears in the Contract Documents, it means furnish and install at the Project site, complete and ready for intended use, as applicable in each instance.
- N. Project, Site: Wherever the term "Project", "Site", or similar such term appears in the Contract Documents, it means the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing Work as part of the Project. The extent of project or site is shown on the Drawings and may or may not be identical with description of land upon which Project is to be built.
- O. District, School District, Owner, etc.: Wherever the term "District", "School District", "Owner", "Cy-Fair ISD", "CFISD", or similar such term appears in the Contract Documents, it means Cypress-Fairbanks Independent School District, 11430 Perry Road, Houston, Texas 77064, (281) 897-4057, or its authorized representative(s).
- P. Installer: Wherever the term "Installer", or any derivative thereof appears in the Contract Documents, it means the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of Work at the Project, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.
- Q. Specialist: Wherever the term "Specialist", or any derivative thereof appears in the Contract Documents, it means an individual or firm of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of Workmen skilled in either (as applicable) manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing Work required by the Contract. Where the Contract Specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item or firm who will perform the Work under the manufacturer's direct supervision.
- R. Testing Laboratory: Wherever the term "Testing Laboratory", or any derivative thereof appears in the Contract Documents, it means an independent entity engaged to perform specific inspections or tests of the Work, either at the Project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

1.5 FORMAT AND SPECIFICATION CONTEXT EXPLANATIONS

- A. Underscoring: Is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where underscoring is used.

- B. Capitalization: Except for manufacturer, product, or trademark names, capitalization is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where capitalization is used.
- C. Imperative language: Is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or when so noted, by others.
- D. Section Numbering: Is used to facilitate cross-reference in Contract Documents. Sections are placed in Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and names of specification sections in Contract Documents.
- E. Page Numbering: Pages are numbered independently for each section. The section number is shown preceded by the project number and followed by the page number at the bottom of each page, to facilitate the location of text. The project number is given to identify the project, for which specification was written, should the section become separated from the Project Manual.
- F. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive, "open-generic descriptive", "compliance with standards", "performance", or a combination of these. The method used for specifying one unit of Work has no bearing on requirements for another unit of Work.

1.6 ABBREVIATIONS

- A. The language of Specifications and other Contract Documents is of the abbreviated type in certain instances and implies words and meanings which will be appropriately interpreted. Actual Work abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the Contract Documents so indicates. A list of typical abbreviations includes but is not limited to the following trade associations and organizations. Refer to Drawings and other Contract Documents for other abbreviations.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Assn.
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
AGA	American Gas Association
AGC	Associated General Contractors of America
AHA	American Hardboard Association
AHGA	American Hotdip Galvanizers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASA	Acoustical Society of America

ASA	American Subcontractors Association
ASC	Adhesive & Sealant Council, Inc.
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Professional Engineers
ASAHC	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASPI	American Wood Preserver's Institute
ASTM	ASTM International
AWI	Architectural WoodWork Institute
AWS	American Welding Society
BIA	Brick Institute of America
BRI	Building Research Institute
CRA	California Redwood Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DHI	Door and Hardware Institute
EPA	Environmental Protection Agency
FTI	Facing Tile Institute
FGMA	Flat Glass Marketing Association
GA	Gypsum Association
HPMA	Hardwood Plywood Manufacturers Association
IBC	International Building Code
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
JSMA	Joint Sealer Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAMM	National Association of Mirror Manufacturers
NBLP	National Bureau of Lathing & Plastering
NCPI	National Clay Pipe Institute
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturers Assn.
NESC	National Environmental Systems Contractors
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NOMMA	National Ornamental Metal Manufacturers Assn
NPVLA	National Paint, Varnish and Lacquer Assn.
NRMCA	National Ready Mixed Concrete Assn.
NRCA	National Roofing Contractors Association
NSPE	National Society of Professional Engineers
NWMA	National WoodWork Manufacturers Assn., Inc.
OSHA	Occupational Safety and Health Administration
PDCA	Painting and Decorating Contractors of America
PI	Perlite Institute, Inc.
PCA	Portland Cement Association
RFCI	Resilient Floor Covering Institute
RVFC	Rubber and Vinyl Floor Council
SBCCI	Southern Building Code Congress International, Inc.
SFPA	Southern Forest Products Association
SHLMA	Southern Hardwood Lumber Manufacturing Assn.
SDI	Steel Deck Institute

SDI	Steel Door Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
VBI	Venetian Blind Institute
VFI	Vinyl Fabrics Institute
WCLIB	West Coast Lumber Inspection Bureau
WRCLA	Western Red Cedar Lumber Association
WWPA	Western Wood Products Association

1.7 DRAWING SYMBOLS

- A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols defined by “Architectural Graphic Standards”, published by the American Institute of Architects (AIA) and John Wiley & Sons, Inc., latest edition. Refer instances of uncertainty to Architect for clarification before proceeding.
- B. Mechanical/Electrical Drawings: Graphic symbols used in Mechanical/Electrical Drawings are generally aligned with symbols recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Where appropriate, those symbols are supplemented by more specific symbols as recommended by other recognized technical organizations, including, but not limited to American Society of Mechanical Engineers (ASME), American Society of Professional Engineers (ASPE), Institute of Electrical and Electronic Engineers (IEEE) and similar organizations. Refer instances of uncertainty to Architect for clarification before proceeding.

1.8 GENERAL REQUIREMENTS

- A. Color, Texture, or Pattern Requirements:
1. When color, texture, or pattern is specified, the item, product, or material shall be furnished in the specified color, texture, or pattern, as applicable.
 2. When more than one (1) approved manufacturer is named in the Specifications, Contractor may select any of the approved manufacturers and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect’s review and selection.
 3. When the term “match existing”, or any derivative thereof appears in the Contract Documents, it means that the sample must match the Owner’s existing Work in every respect as to color, texture, and pattern, as applicable.
 4. When the term “match Architect’s approved sample”, or any derivative thereof appears in the Contract Documents, it means that the Architect has selected a sample which must be matched in every respect as to color, texture, and pattern, as applicable.
 5. When an item or product is specified of a manufacturer for which only one (1) color, texture, or pattern is available, and a color, texture, or pattern other than that one is specified, Contractor shall bring it to the attention of the Architect for a decision prior to proceeding with the Work. Do not proceed with the Work until Architect has approved the color, texture, and pattern, as applicable.
 6. When an item or product is specified of a manufacturer for which no color, texture, or pattern is specified, and colors, textures, and patterns are available, Contractor shall bring it to the attention of the Architect and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect’s review and selection. Do not proceed with the Work until Architect has selected and approved the color, texture, and pattern, as applicable.

7. When due to the nature of the item, product, or material, i.e., face brick, tile pavers, natural stone, etc, Contractor shall submit sample or samples which exhibits the full range of characteristics (colors, i.e. lights and darks, as well as textures, and patterns) for which the item, product, or material is available. The Architect will select the color, texture, and pattern, as applicable, from those available and request a sample panel exhibiting the approved characteristics. The approved color range, texture, and pattern, as applicable will then become the standard for which all Work on the project will be judged. Architect will be final judge as to having performed Work in conformance with approved characteristics.
 8. Under no circumstances are colors, textures, patterns, or any other characteristics for which an item, product, or material are available to be selected by anyone other than the Architect or Owner.
 9. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- B. Continuity of Building Envelope, Full Height Partitions, and Fire Rated Construction:
1. Continuity of Building Envelope:
 - a. All materials such as exterior sheathing, membrane flashings, vapor barriers, insulations, dampproofing, waterproofing, roofing, flashings, etc. and all penetrations, holes, gaps, joints, and openings through such materials shall be sealed to ensure continuity of building envelope, whether indicated or not to eliminate moisture penetration.
 - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
 2. Full Height Partitions:
 - a. All full height partitions shall be from floor to bottom of deck structure and shall be made to fit around steel joists, beams, etc., whether indicated or not.
 - b. Seal joints at top of partitions, in flutes of steel deck, and around structural elements with a compressible filler and/or sealant to accommodate movement due to expansion, contraction, and deflection, whether indicated or not. Treat seals in joints of fire rated partitions as specified below for fire rated construction, whether indicated or not.
 - c. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
 3. Fire Rated Construction:
 - a. All seals in fire rated construction, whether at top, bottom, or penetrations through fire rated construction, shall be made with firestopping and firesafing materials to maintain fire rating integrity of construction and satisfy authorities having jurisdiction, whether indicated or not.
 - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
- C. Plumbing Line Protection:
1. Placing or washing materials, including, but not limited to the following, down any plumbing line or fixture is strictly forbidden.
 - a. Concrete, cement, sludge, mortar, grout, plaster, or any other cementitious material
 - b. Paint, paint thinner, turpentine, kerosene, gasoline, oil, or any other petroleum or hazardous products.
 2. Cleaning painting equipment, including brushes in new or existing plumbing fixtures is strictly prohibited.
 3. Contractor shall certify that all affected plumbing lines and fixtures are clean, free flowing and running. Plumbing lines and fixtures damaged as a result of any of the above shall be repaired or replaced at no expense to Owner. Contractor shall bear responsibility and all costs of fines, penalties, and legal fees attributed to violations as levied by authorities having jurisdiction.

- D. Support from Structure: Ducts, pipes, conduits, equipment, and other items indicated to be supported from the structure shall be accomplished using approved hangwires, hangers, or devices of type, size and material recommended to suit the application and installed in accordance with recommendations of the hanger or device manufacturer, Architect and/or Structural Engineer, or code authorities having jurisdiction, whichever is the more stringent requirement. Nothing shall be hung from the structure unless directed to do so by the Architect and/or Structural Engineer.
- E. Ducts, Pipes, Conduits, and Wires: Shall be concealed in walls, chases, and enclosed areas out of view, unless specifically indicated as exposed or where exposure is required for proper function of item, such as air registers, air returns, louvers, grilles, vents, thermostats, electrical receptacles, telephone/data terminals and jacks, light switches, etc. Refer instances of uncertainty to Architect for clarification before proceeding.
- F. Fasteners:
1. Unless specifically indicated or directed otherwise, all fasteners in Work exposed to view, shall be concealed in the finished Work.
 2. No fasteners shall show through or telegraph through exposed face of finished Work and all finished surfaces shall be free of all evidence of the existence of fasteners.
 3. Fasteners shall be spaced to accurately and rigidly secure Work in place.
 4. If not shown or otherwise required or recommended by manufacturer, standard, or code authorities having jurisdiction, fastener spacing shall not exceed 12 inches on center.
 5. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- G. Exposed Metal Work:
1. Unless specifically indicated or directed otherwise, all exposed metal Work shall be flat with all surfaces free of distortions, oil canning, waves, dents, scratches, weld marks, and other surface defects detrimental to good appearance or function.
 2. All steel exposed to exterior shall be hot-dip galvanized, phosphate treated for paint retention and shop prime painted.
 3. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 21 00

ALLOWANCES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to the Section.

PART 1 – GENERAL

Refer to Document AB for Substitutions of Materials and Equipment

1.1 CONDITIONS

- A. ALLOWANCES shall be included in the Contract sum as specified within this Specification Section in paragraph 3.1 below. These sums shall be reconciled as per AIA Document A201™–2017, as amended.
- B. Where allowances are for materials only, the cost of delivery to the job site may be funded from such allowance.
- C. Allowances are hereby established for the items in the amounts listed below. If any items exceed the amount listed, such excess cost shall be paid by the Owner. If any items cost less than the amount listed, the Owner shall be given a credit in the amount of the difference. Costs of items listed below are to be net costs to the General Contractor or Subcontractor, whichever makes the direct purchase.
- D. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. These allowances shall cover the net cost of the materials and equipment delivered and unloaded at the site, and all applicable taxes.
 - 1. The Contractor's handling costs on site, labor, installation cost, estimating, labor burden, overhead, profit and other expenses contemplated for the original allowances shall be included in the Contractor's Sum and not in the allowance. Subcontractor and sub-subcontractor markups are allowable as provided in AIA Document A201™–2017, as amended.
 - 2. The Contractor shall cause the work covered by these allowances to be performed for such amounts and by such persons as the Architect may direct, but he will not be required to employ persons against whom he makes reasonable objection.
 - 3. The cost, when determined, is more than or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order which may include additional handling costs on the site, labor, installation costs, overhead, profit, cleaning, as-builts, standard warranty, cost to update electronic record documents and other expenses resulting to the Contractor from any increase over the original allowance if approved.
- E. Contractor shall proceed with the work in question only after receiving written directions executed by the Owner and the Architect. Owner will not be obligated to pay the cost of any work without prior authorization. This written directive shall consist of Owner's representative and Architect's signature on Change Proposal Request document submitted by General Contractor with any applicable amendments if required indicating such approval. The Architect and Owner shall respond in a timely manner to document approved Change Proposal Request (CPR) expenditures and credits from such allowances within the contract. The Contractor may request payment for such approved expenditures only upon completion of the work and the completion of a fully executed CPR formally documenting allowance expenditure credits. The Contractor's overhead and profit relative to these allowance sums and work performed in accordance herewith, shall be included in the total Proposal prices, thus not included in the allowance sum. Unexpended balance of allowance sums shall revert to the Owner by Change Order in the final settlement of the contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 ALLOWANCES

- A. Owner's Betterment Allowance: \$1,604,400.00
1. Contractor shall include the amount indicated above in his Base Proposal as a contingency to cover the cost of additional scope of work. Contractor shall proceed with the work in question only after receiving written directions executed by the Owner and the Architect. Owner will not be obligated to pay the cost of any work performed without prior written authorization. The Contractor's overhead and profit relative to this contingency sum and work performed in accordance herewith, shall be included in the total Base Proposal price, but not included in the contingency sum. Unexpended balance of contingency sums shall revert to the Owner via Change Order during project closeout. Other scopes to be funded from this allowance may include, but are not limited to:
 - Temporary Freezer Box (Berry Center)
 - BMCS (Campbell MS, JVHS, Cy Ranch HS, Berry Center)
 - Landscape Restoration (Berry Center)
 - Cooling Tower Refurbishment (Cy Ranch HS)

END OF SECTION

SECTION 01 22 00

MEASUREMENT AND PAYMENT (UNIT PRICES)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Refer to Document AB for Substitutions of Materials and Equipment

1.1 SECTION INCLUDES

- A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
- B. Defect assessment and non-payment for rejected work.

1.2 AUTHORITY

- A. Measurement methods delineated in the individual specification sections complement the criteria of this Section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. The Architect will verify measurements and quantities.

1.3 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Contract Documents are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect determine payment.
- B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.4 MEASUREMENT OF QUANTITIES

- A. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested, and certified by the applicable State Weights and Measures Department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering Devices: Inspected, tested, and certified by the applicable State department within the past year.
- B. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.5 PAYMENT

- A. Payment Includes: Full compensation for all required labor, labor burden, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities confirmed and accepted by the Architect multiplied by the unit/sum price for work which is incorporated in or made necessary by the Work.

1.6 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.
- C. The authority of the Architect to assess the defect and identify payment adjustment is final.

1.7 NON-PAYMENT FOR REJECTED PRODUCTS

- A. Payment will not be made for any:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the work.
 - 6. Loading, hauling and disposing of rejected Products.

PART 2 – DESCRIPTION OF UNIT PRICES

2.1 GENERAL

- A. For the work described unit pricing shall be used to determine the additional cost or credit to the contract amount or added to or deducted from the Owner's contingency for changes in the scope of work made during the progress of the work as directed by Architect.
- B. The same price shall be used for adding or deducting from the scope of work. No exceptions.
- C. The following unit prices shall be included in the proposal form and shall be included in the Owner-Contractor agreement.

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Prices shall be used, where applicable, to make adjustments to the cost of the work due to changes. All Unit Prices submitted shall be complete "turnkey" prices for fully functioning systems, and shall include all costs for overhead, profit, labor, labor burden, material, equipment, and any other incidentals related to the completion of the Work and shall remain firm for the duration of the contract. Unit prices listed are for additive and/or deductive work.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 ALTERNATE PRICES

- A. Contractor shall state, in the spaces provided in the proposal form, Alternate Prices for the work described below. The responsibility of determining quantity of Alternates rests with the Contractor. Base Proposal and Alternates shall include cost of all supporting elements required, so that no matter what combination of Base Proposal and Alternates are accepted, that portion shall be a complete entity. Work for all Alternates shall be in strict accordance with the specification sections noted and applicable to the specific work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 ALTERNATES

- A. **Alternate Number 1: Base Bid Adjustment**
This alternate shall establish the adjustments to the General Contractor's Base Proposal submitted at 2:00 pm, if necessary. This alternate shall be accepted whether it is an add or a deduct and will be used as part of the evaluation process to determine the best value for the District.
- B. **Alternate Number 2:**
Berry Center
Alternate No. 2A: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1, CH-2 and CH-3 as Water Cooled Magnetic Bearing Centrifugal chillers with VFD as manufactured by Daikin as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

Alternate No. 2B: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1 as a Water Cooled Magnetic Bearing Centrifugal chillers with VFD and CH-2 and CH-3 as Water Cooled Centrifugal chillers with VFD as manufactured by Trane as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.
- C. **Alternate Number 3:**
Campbell MS
Alternate No. 3A: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install a Water Cooled Magnetic Bearing Centrifugal chiller with VFD as manufactured by Daikin as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

Alternate No. 3B: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install a Water Cooled Magnetic Bearing Centrifugal chiller with VFD as manufactured by Trane as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

D. **Alternate Number 4:**

Cy Ranch HS

Alternate No. 4A: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1, CH-2, CH-3 and CH-4 as Water Cooled Magnetic Bearing Centrifugal chillers with VFD as manufactured by Daikin as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

Alternate No. 4B: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1, CH-2 and CH-3 as Water Cooled Centrifugal chillers with VFD and CH-4 as a Water Cooled Magnetic Bearing Centrifugal chiller as manufactured by Trane as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

E. **Alternate Number 5:**

Jersey Village HS

Alternate No. 5A: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1, CH-2 and CH-3 as Water Cooled Magnetic Bearing Centrifugal chillers with VFD as manufactured by Daikin as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

Alternate No. 5B: This alternate shall establish the amount to be added to the base proposal for the Contractor to furnish and install CH-1 as a Water Cooled Magnetic Bearing Centrifugal chillers with VFD and CH-2 and CH-3 as Water Cooled Centrifugal chillers with VFD as manufactured by Trane as shown on the drawings and listed in the specifications. There are no chillers included in the base proposal.

3.2 GENERAL NOTES

- A. Unless otherwise indicated, scope of work for each alternate shall include material and labor, general conditions and all other costs associated with completing the work described.
- B. Alternates are not listed in any order of priority.
- C. Acceptance of alternates shall be the sole discretion of the Owner.
- D. See Section AB for alternate pricing timelines.

END OF SECTION

SECTION 01 29 73

SCHEDULE OF VALUES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.
- B. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.

1.2 QUALITY ASSURANCE

- A. Use required means to assure arithmetical accuracy of the sums described. All calculations shall be to two (2) decimal places.
- B. When so required by the Owner, provide copies of the subcontracts or other data acceptable to the Owner, substantiating the sums described.

1.3 SUBMITTALS

- A. Prior to the first Application for Payment, submit a proposed Schedule of Values to the Owner and Architect as outlined below:
 - 1. Meet with the Owner and Architect and determine additional data, if any, required to be submitted.
 - 2. Secure the Owner's approval of the Schedule of Values prior to submitting first Application for Payment.

1.4 SCHEDULE OF VALUES

- A. The Schedule of Values shall be broken down into item costs for each specification section as a minimum with materials and labor separated. After review by the Owner and Architect, the Schedule of Values shall be broken down into further items as required. (See following list).
- B. Schedule of Values: Refer to the following sample.
- C. Indicate page subtotals on each page of Schedule of Values.
- D. Each page to be printed single-sided.
- E. Schedule of Values is to be submitted for approval per AIA Document A101, Article 3.3

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

- A. Refer to sample attached herein.

SECTION 01 29 73
SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Matls	Total Completed	%
			Previous App.	This App.			
	NOTE: IF PROJECT CONSISTS OF BOTH NEW ADDITION(S) AND REMODEL (S), EACH SHALL HAVE A SEPARATE SCHEDULE OF VALUES. Listing shall include but not be limited to: Div. 1 - General Conditions Sitework Supervision Mobilization Contractor's Fee General Conditions Temp. Facilities Project sign Coordination drawings Final Cleaning As-Builts/Close-out/O&M Manuals/Record Drawings Permits Bonds Insurance Contractor's written Punch List Div. 2 - Existing Conditions Div. 3 - Concrete Drilled Piers Matls Drilled Piers Labor Caps & Beams Matls Caps & Beams Labor Slab on Grade Matls Slab on Grade Labor Cooling Tower Basin Matls Cooling Tower Basin Labor Misc. Bldg Concrete Matls Misc. Bldg Concrete Labor Rebar Matls Rebar Labor Lt. Wt. Insul Fill - Matls Lt. Wt. Insul Fill - Labor Close-out Documents Punch List						

Div. 4 - Masonry

Brickwork - Matls
 Brickwork - Labor
 Concrete Masonry - Matls
 Concrete Masonry - Labor
 Str. Glazed Tile - Labor
 Str. Glazed Tile - Matls
 Masonry clean up/acid wash
 Close-out Documents
 Punch List

Div. 5- Metals

Structural Steel - Matls
 Structural Steel - Labor
 Misc. Steel - Matls

 Steel Joists - Matls

 Lt. Gauge Steel Framing - Matls
 Lt. Gauge Steel Framing - Labor
 Metal Decking - Matls
 Metal Decking - Labor
 Expansion Covers - Matls
 Expansion Covers - Labor
 Alternating Stairs Matls
 Alternating Stairs Labor
 Close-out Documents
 Punch List

Div. 6 - Wood & Plastics

Rough Carpentry - Matls
 Rough Carpentry - Labor
 Millwork - Matls
 Millwork - Labor

Div. 7 - Thermal & Moisture Protection

Waterproofing & Dampproofing Matls
 Waterproofing & Dampproofing Labor
 Building Insulation - Matls
 Building Insulation - Labor
 Fireproofing - Matls
 Fireproofing - Labor
 Metal Roof - Matls
 Metal Roof - Labor
 Metal Roof Guarantee
 Modified Bitumen Roofing Base Sheet- Matls
 Modified Bitumen Roofing Base Sheet - Labor
 Modified Bitumen Roofing Cap Sheet - Matls

Modified Bitumen Roofing Cap Sheet - Labor
Modified Bitumen Roofing - Guarantee
Building Sheet Metal - Matls
Building Sheet Metal - Labor
Bldg. Sheet Metal Guarantee
Roof Curbs Matls
Roof Curbs Labor
Roof Hatches Matls
Roof Hatches Labor
Sealants Matls
Sealants Labor
Roof Accessories Matls
Roof Accessories Labor
Close-out Documents
Punch List

Div. 8 - Doors & Windows

Finish Carpentry/Door - Matls
Finish Carpentry/Door - Labor
Finish Hardware - Matls
Finish Hardware - Labor
Thresholds & Seals Matls
Thresholds & Seals Labor
Hollow Metal Doors & Frames - Matls
Hollow Metal Doors & Frames - Labor
Plastic Faced Doors - Matls
Plastic Faced Doors - Labor
Overhead Doors & Grilles - Matls
Overhead Doors & Grilles - Labor
Alum. Entrances & Storefronts - Matls
Alum. Entrances & Storefronts - Labor
Alum. Windows - Matls
Alum. Windows - Labor
Glass & Glazing - Matls
Glass & Glazing - Labor
Glass & Glazing - water test
Close-out Documents
Punch List

Div. 9 - Finishes

Lath & Plaster - Matls
Lath & Plaster - Labor
Gypsum Wallboard Systems - Matls
Gypsum Wallboard Systems - Labor
Ceramic Tile - Matls
Ceramic Tile - Labor
Quarry Tile - Matls
Quarry Tile - Labor
Terrazzo - Matls

Terrazzo - Labor					
Acoustic Clg. - Matls					
Acoustic Clg. - Labor					
Acoustic Wall Panels - Matls					
Acoustic Wall Panels - Labor					
Resilient Flooring - Matls					
Resilient Flooring - Labor					
Carpet - Matls					
Carpet - Labor					
Athletic Flooring - Matls					
Athletic Flooring Labor					
Floor Sealer - Matls					
Floor Sealer - Labor					
Painting - Matls					
Paint - Labor					
Close-out Documents					
Punch List					
Div. 10 - Specialties					
Tackboards - Matls					
Tackboards - Labor					
Toilet Partitions - Matls					
Toilet Partitions - Labor					
Louvers - Matls					
Louvers - Labor					
Aluminum Flag Pole - Matls					
Aluminum Flag Pole - Labor					
Graphics -Matls					
Graphics -Labor					
Lockers Matls					
Lockers Labor					
Locker combinations in Excel format					
Demountable Partitions - Matls					
Demountable Partitions - Labor					
Metal Shelving Matls					
Metal Shelving Labor					
Scoreboards - Matls.					
Scoreboards - Labor					
Toilet Room Accessories - Matls					
Toilet Room Accessories - Labor					
Visual Display Boards - Matls					
Visual Display Boards - Labor					
Cubicle Curtains & Track - Matls					
Cubicle Curtains & Track - Labor					
Fire Extinguisher Cabinets Matls					
Fire Extinguisher Cabinets Labor					
Close-out Documents					
Punch List					

Div. 11 - Equipment

Stage Curtains Matls
 Stage Curtains Labor
 Stage rigging Matls
 Stage rigging Labor
 Stage lighting Matls
 Stage lighting Labor
 Misc. Appliances Matls
 Misc. Appliances Labor
 Food Service - Submittals/coordination drawings
 Food Service - Walk-ins Matls
 Food Service - Walk-ins Labor
 Food Service - Flatwork - Matls
 Food Service - Flatwork - Labor
 Food Service Eqpt - Labor
 Food Service Eqpt - Matls
 Food Service - Close-out Documents
 Food Service - Training
 Food Service - Kitchen Hoods - Matls
 Food Service - Kitchen Hoods - Labor
 Food Service - Ansul Syst. - Matls
 Food Service - Ansul Syst. - Labor
 Close-out Documents
 Punch List

Div. 12 - Furnishings

Casework - Matls
 Casework - Labor
 Science Casework - Matls
 Science Casework - Labor
 Horizontal Blinds - Matls
 Horizontal Blinds - Labor
 Projection Screen - Matls
 Projection Screen - Labor
 Close-out Documents
 Punch List

Div. 13 - Special Construction

Div. 14 - Conveying Systems

Elevator - Matls
 Elevator - Labor
 Elevator - Maintenance Agreement

Div. 21 - Fire Suppression

Fire Sprinkler Syst. - Eng/Submittals
 Fire Sprinkler Syst. - Underground piping/Vault -
 Matls
 Fire Sprinkler Syst. - Underground piping/Vault -

Labor						
Fire Sprinkler Syst. - Above slab piping - Matls						
Fire Sprinkler Syst. - Above slab piping - Labor						
Fire Sprinkler Syst. - Trim-out - Matls						
Fire Sprinkler Syst. - Trim-out - Labor						
Fire Sprinkler Syst. - Start-up/Testing						
Fire Sprinkler Syst. - Close-out Documents						
Close-out Documents						
Punch List						
Div. 22 - Plumbing						
Shop Drawings						
Coordination Drawings						
As-Builts/Close-out O&M Manuals						
Sanitary Underground - Matls						
Sanitary Underground - Labor						
Storm Underground - Matls						
Storm Underground - Labor						
Domestic Water - Matls						
Domestic Water - Labor						
Plumbing Dissolution Matls						
Plumbing Dissolution Labor						
Gas Piping - Matls						
Gas Piping - Labor						
Grease Trap - Matls						
Grease Trap - Labor						
Fixtures - Matls						
Fixtures - Labor						
Rodding/Camera lines						
Div. 23 - Heating Ventilating and Air Conditioning						
Shop Drawings						
As-Builts/Close-out O&M Manuals						
Coordination drawings						
Chillers - Matls						
Chillers - Labor						
Cooling Towers - Matls						
Cooling Towers - Labor						
Boilers - Matls						
Boilers - Labor						
AHU's - Matls						
AHU's - Labor						
Fans - Matls						
Fans - Labor						
Grilles -Matls						
Grilles - Labor						
Ductwork - Matls						
Ductwork - Labor						

Pumps - Matls						
Pumps - Labor						
Water Treatment - Matls						
Water Treatment - Labor						
Isolation - Matls						
Isolation - Labor						
Pipe Flex - Matls						
Pipe Flex - Labor						
Sheet Metal - Matls						
Sheet Metal - Labor						
Duct Insulation - Matls						
Duct Insulation - Labor						
Pipe Insulation - Matls						
Pipe Insulation - Labor						
Pipe, Valves, Fittings - Matls						
Pipe, Valves, Fittings - Labor						
Misc. - Labor						
Misc. - Matls						
Insulation - Matls						
Insulation - Labor						
Sanitary Above Slab - Matls						
Sanitary Above Slab - Labor						
Storm Above Slab - Labor						
Storm Above Slab - Matls						
Gas - Matls						
Gas - Labor						
Fixtures - Matls						
Fixtures - Labor						
Permits						
VAV Boxes - Matls						
VAV Boxes - Labor						
Refrigerant Monitor - Matls						
Refrigerant Monitor - Labor						
Unit Heaters - Matls						
Unit Heaters - Labor						
Startup						
Controls						
Eng/Submittals						
Valves/Dampers - Matls						
Valves/Dampers - Labor						
Box Controls - Matls						
Box Controls - Labor						
Modules -Matls						
Modules -Labor						
End Devices - Matls						
End Devices - Labor						
Low Voltage Wiring - Matls						
Low Voltage Wiring - Labor						

Startup/commissioning
Software Installation/Graphics upload to CFISD server
Close-out Documents
Training
Punch List

Div. 26 - Electrical

Mobilization
Shop Drawings
As-Builts/Close-out/O&M Manuals
Underground - Matls
Underground - Labor
Conduit -Matls
Conduit - Labor
Wire - Matls
Wire - Labor
Feeder Wire - Matls
Feeder Wire -Labor
Switches/Recpt. Matls
Switches/Recpt. Labor
Switchgear - Matls
Switchgear - Labor
Temporary - Matls
Temporary - Labor
Gas Generator - Matls
Gas Generator - Labor
Fixtures - Matls
Fixtures - Labor
Low Voltage - Engineering/Submittals
Low Voltage Lighting- Devices - Matls
Low Voltage Lighting- Devices - Labor
Low Voltage Lighting - Wiring - Matls
Low Voltage Lighting - Wiring - Labor
Low Voltage Lighting - Programming/Start-up
Low Voltage Lighting- Training
Low Voltage Lighting - Close-out Documents
Voice System - Wiring - Matls
Voice System - Wiring - Labor
Video System - Trim-out - Matls
Video System - Trim-out - Labor
Video System - Testing
Master Clock - Matls
Master Clock - Labor
Close-out Documents
Punch List
Coordination Drawings

Div. 27 - Communications

Data System - Matls
Data System - Labor
Data System - Testing
Communications/PA - Control Panels - Matls
Communications/PA - Control Panels - Labor

Div. 28 - Electronic Safety and Security

Fire Alarm - Control Panel - Labor
Fire Alarm - Wiring - Matls
Fire Alarm - Wiring - Labor
Fire Alarm - Devices - Matls
Fire Alarm - Devices - Labor
Fire Alarm - Testing
Fire Alarm - Training
Fire Alarm - Close-out Documents
Security Systems - Submittals
Security Systems - Devices - Matls
Security Systems - Devices - Labor
Security Systems - Wiring - Matls
Security Systems - Wiring - Labor
Security Systems - Cameras Matls
Security Systems - Cameras Labor
Security Systems - DVR Equipment - Matls
Security Systems - DVR Equipment - Labor
Security Systems - Programming/Start-up
Security Systems - Training
Security Systems - Close-out Docs.
Video System - Close-out Docs

Div. 31 - Earthwork

Detention pond Final County inspection permit
document
Demolition (as applicable)
Site Clearing & Grubbing
Earthwork - Matls
Earthwork - Labor
Finish Grading Matls
Finish Grading Labor
Stabilization Matls
Stabilization Labor
Site Drainage - Matls
Site Drainage - Labor

Div. 32 - Exterior Improvements

Chain Link Fence - Matls
Chain Link Fence - Labor
Paving - Matls
Paving - Labor
Sidewalks - Matls

	Sidewalks - Labor					
	Erosion Control - Matls					
	Erosion Control - Labor					
	Building Pad - Matls					
	Building Pad - Labor					
	Paving Subgrade					
	Signage/Striping					
	Bike Racks					
	Landscaping - Matls					
	Landscaping - Labor					
	Sod - Matls					
	Sod - Labor					
	Hydromulch - Matls					
	Hydromulch - Labor					
	Irrigation - Matls					
	Irrigation - Labor					
	Irrigation system testing/demonstration					
	Div. 33 - Utilities					
	Site Storm - Matls					
	Site Storm - Labor					
	Site Sanitary - Matls					
	Site Sanitary - Labor					
	U/G Fire Line - Matls					
	U/G Fire Line - Labor					
	Site Lighting - Matls					
	Site Lighting - Labor					
	Close-out Documents					
	Punch List					
	Alternates					
1						
2						
3						
4						
5						
	Allowances:					
	A. Owner's Betterment Allowance					

General Note: Close-out lists shall include As-builts, O&M's, Demonstration/Training, and any attic owner's stock.

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. General: notify the Architect whenever there is need of clarification or interpretation of the Contract Documents prior to commencement of work.
- B. Commencement of work without Architect's prior notification means Contractor's acceptance of responsibility.
- C. Commencement of work without Architect's prior notification implies Contractor's understanding of conditions, assemblies, methods, or procedures.
- D. The project superintendent shall notify the Owner on an ongoing basis of ongoing work.

1.2 PRE-INSTALLATION CONFERENCE

- A. General: Notify the Architect 48 hours in advance of certain stages of construction, and, as required by the Architect, organize a pre-installation meeting with each trade individually prior to commencement of their portion of the Work. At a minimum, representatives of the Architect, the General Contractor's project superintendent, and the Sub-contractor's Foreman and Project Manager shall be present at each meeting. The Engineer shall be notified as applicable.
- B. As indicated in each specific section of this Project Manual, or as required by the Architect, these stages generally include, but are not necessarily limited to the following:
 - 1. Division 2 - (Selective) Demolition.
 - 2. 05 50 00 - Miscellaneous metals, ladders, brackets, pipe rails, etc.
 - 3. Division 6 - Finish Carpentry and Millwork
 - 4. Division 7 - installation of waterproofing, vapor barriers, flashing and sheet metal.
 - 5. Division 7 - Installation of roofing system(s) and associated work.
 - 6. 07 21 00 - Concealment of insulation.
 - 7. Division 8 - Installation of doors, frames, windows, and storefronts.
 - 8. 08 71 00 - Installation of finish hardware
 - 9. Division 9 - Installation of plaster and gypsum board products.
 - 10. Division 9 - Installation of tile, flooring, and pavers.
 - 11. 09 51 00 - Installation of acoustical ceiling (grid and panels).
 - 12. 09 65 19 - Installation of resilient flooring and base.
 - 13. 09 91 00 - Painting and staining (each coat).
 - 14. Divisions 22, 23 and 26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
 - 15. Division 23 - Installation of heating, ventilating and air conditioning.
 - 16. Division 26 - Installation of all electrical fixtures.
 - 17. Divisions 22, 23 and 26 - Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
 - 18. 31 00 00 - Clearing and stripping of top soil within limits of grading.
 - 19. 31 00 00 - (Excavation and) Placing (of each lift of) select fill material, and site grading.
 - 20. 31 00 00, 31 23 23.13, and Divisions 22, 23 and 26 - Compaction, inspection, testing, and covering of underground utilities.
 - 21. Division 32 - Installation of site amenities, fencing, surfaces, landscaping, etc.

- C. In addition to notifying the Architect, notify the Structural Engineer (48 hours) prior to the following stages:
1. Drilling, reinforcing, and placing of first piers and footings.
 2. Placing first reinforcing and grade beams.
 3. Erecting structural steel elements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

3.2 CONFERENCES AND MEETINGS

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

- A. The Architect will:
 - 1. Schedule each meeting (pre-construction conference, periodic project meetings, pre-installation meetings, and specially called meetings throughout the progress of the work).
 - 2. Prepare agenda for meetings.
 - 3. Preside at meetings, including all significant proceedings and decisions.
 - 4. record, reproduce, and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
 - a. All participants in the meeting.
 - b. All parties affected by decisions made at the meeting.
- B. The Contractor shall:
 - 1. Make physical arrangement for meetings.
 - 2. Participate in all meetings and conferences.
 - 3. Schedule attendance of Job Superintendent, Project Manager, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
 - 4. Provide updated schedules.
 - 5. Provide status reports/logs of RFIs, CPRs, MCs, and shop drawings/submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. Architect will:
 - 1. administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
 - 2. administer site mobilization conference for clarification of Owner and Contractor.
- B. Location: At Project site or as designated by the Architect.
- C. Attendance:
 - 1. Contractor or Contractor's Representative
 - 2. Job Superintendent
 - 3. Project Manager
 - 4. Owner or Owner's Representative
 - 5. Major subcontractors
 - 6. Major suppliers
 - 7. Architect's Representative
 - 8. Consultants as needed
 - 9. Third-party Consultants
 - 10. Others as appropriate

- D. Meeting Agenda, may include, but is not limited to:
1. Discussion on major subcontracts and suppliers and projected construction schedules.
 2. Critical work sequencing.
 3. Major equipment deliveries and priorities. Discussion of long lead time items.
 4. Project coordination and designation of responsible personnel.
 5. Procedures and processing of field decisions, proposal requests, requests for information (RFIs), submittals, minor changes, change orders and applications for payment.
 6. Method of distribution of contract documents.
 7. Procedures for maintaining record documents.
 8. Use of premises, office work and storage areas, on-site parking, and owner's requirements.
 9. Construction facilities and temporary utilities.
 10. Housekeeping procedures.
 11. Special owner requirements (specifications sections 01 35 23, 01 35 23.1 and 01 35 23.2)
 12. Lien release requirements

3.2 PRE-DEMOLITION CONFERENCE

- A. Owner will:
1. Administer pre-demolition conference for the establishment of communication methods related to demolition procedures and Owner coordination and scheduling requirements for demolition scope.
- B. Location: At Project site or as designated by the Architect.
- C. Attendance:
1. Contractor or Contractor's Representative
 2. Job Superintendent
 3. Project Manager
 4. Owner or Owner's Representative
 5. Major Subcontractors
 6. Demolition Subcontractors
 7. Architect's Representative
 8. Consultants as needed
 9. Third-Party Consultants
 10. Others as appropriate
- D. Meeting Agenda, may include, but is not limited to:
1. Discussion on projected demolition schedules.
 2. Procedures for coordination of demolition sequencing and scheduling.
 3. Procedures for coordination associated with existing building components need to be returned to Owner.
 4. Project demolition coordination and designation of responsible personnel.
 5. Procedures for maintaining record documents.
 6. Special owner requirements (specifications section 01 36 13).

3.3 PROGRESS MEETINGS

- A. Architect will:
1. Schedule project meetings throughout progress of the work at intervals to be determined.
 2. Set agenda and administer said meetings.
 3. Preside over meetings.
 4. Record meeting minutes, including all significant proceedings and decisions.
 5. Reproduce and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
 - a. All participants in the meeting.

- b. All parties affected by decisions made at the meeting.
- B. Contractor shall:
 - 1. Make physical arrangements for meetings.
- C. Attendance:
 - 1. Contractor or Contractor's Representative
 - 2. Job Superintendent
 - 3. Project Manager
 - 4. Owner or Owner's Representative
 - 5. Major subcontractors
 - 6. Architect's Representative
 - 7. Consultants as needed
 - 8. Others as appropriate
- D. Meeting Agenda, may include, but is not limited to:
 - 1. Review and approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems, and conflicts.
 - 4. Review of off-site fabrication and delivery schedules.
 - 5. Corrective measures and procedures to regain projected schedule.
 - 6. Review three week "look-ahead" construction schedule.
 - 7. Maintenance of quality standards.
 - 8. Response to request for information (RFIs) and status of outstanding RFIs.
 - 9. Status of submittals.
 - 10. Status of CPRs.
 - 11. Status of MCS.
 - 12. Other items and critical issues affecting work.

3.4 PRE-INSTALLATION CONFERENCES

- A. Architect will convene a pre-installation conference, when required in individual specification Section, prior to the Contractor commencing Work of the Section. The Contractor will produce agenda, Architect will distribute copies of the pre-installation conference minutes within seven (7) days, excluding weekends and holidays, after each conference to all participants in the meeting, the Owner and all parties affected by decisions made at the meeting.
- B. Attendance:
 - 1. Contractor's Superintendent(s)
 - 2. Subcontractor's Foreman
 - 3. Contractor's Project Manager(s)
 - 4. Architect's Representative
 - 5. Consultants as needed
 - 6. Owner or Owner's Representative
 - 7. Manufacturer's Representative
 - 8. Others affecting or affected by Work.
 - 9. Third party inspectors
- C. Meeting Agenda, may include, but is not limited to:
 - 1. Review of conditions of installation.
 - 2. Preparation and installation procedures.
 - 3. Coordinate with related work
 - 4. Review of the contract document requirements.
 - 5. Questions related to work required.
 - 6. Mockup samples or panels

3.5 MONTHLY PAY APPLICATION REVIEW MEETINGS

- A. The Owner, Architect, and Contractor shall schedule and conduct monthly Pay Application review meetings during the entire duration of construction prior to the submission of the notarized completed Contractor Application for payment to the Architect for certification. The Contractor shall produce a draft of the proposed Application for Payment for review by the Owner and Architect. The Contractor shall include and furnish the following documents for review:
 - a. Draft of the Contractor's Application for Payment (AIA Document G702)
 - b. Invoices for any stored materials included in the Application. Invoices shall include full descriptions and costs as required to facilitate on-site review
 - c. Release of Liens from Subcontractors and Sub-subcontractors for all work billed in previous certified Applications for Payment.
 - d. Owner reserves the right to require Release of Liens for any previously submitted notice of claim submitted by any Subcontractor, Sub-subcontractor, or suppliers.
 - e. Evidence of payment for any and all backcharges, overtime, etc. previously issued by Owner that would be past due by the time payment is made by Owner.
 - f. Pay Application review checklists fully completed.
 - g. Updated project schedule
 - h. Owner may withhold payment on line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received and accepted by Owner.
- B. Attendance:
 - a. Owner's representative
 - b. Architect
 - c. Contractor
 - d. Subcontractors as appropriate
- C. Meeting agenda may include, but is not limited to:
 - a. Review percentages of work completed and being billed to date.
 - b. Review of any stored materials being billed to date and all associated surety recommendations
 - c. Review of lien releases, notices of claims, etc.
 - d. Confirmation of approved CPRs
- D. The meeting date shall be determined by the Architect, Contractor, and Owner, and shall occur on that same date each month.

3.6 SAMPLE MEETING AGENDA

Refer to the following pages for a sample Pre-Construction Meeting agenda.

3.7 SUBMISSION OF FINALIZED APPLICATION FOR PAYMENT

Refer to AIA Document A201™-2017, as amended, Article 9.

SAMPLE PRECONSTRUCTION MEETING AGENDA:

PROJECT NAME
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT

**CYPRESS-FAIRBANKS I.S.D. BID NUMBER:
PRE-CONSTRUCTION CONFERENCE**

AGENDA

Date: _____
Time: _____
Location: Cypress-Fairbanks Independent School District
Facilities and Construction Office
11430 Perry Road
Houston, Texas 77064

I. INTRODUCTION OF PERSONNEL

A.	OWNER: 1. Name	Cypress-Fairbanks I.S.D. Title	(281) 897-4108 Phone Number
B.	ARCHITECT: 1. Name	Title	Phone Number
C.	CONTRACTOR: 1. Name	Title	Phone Number
D.	THIRD PARTY INSPECTORS 1. Name	Title	Phone Number

II. REVIEW CONSTRUCTION GUIDELINE REQUIREMENTS

III. SUB/TRADE START-UP MEETINGS

IV. REVIEW CONSTRUCTION PROGRESS MEETING PROCEDURES

V. SPECIAL OWNER REQUIREMENTS

VI. DOCUMENTS MODIFYING AND/OR CLARIFYING THE CONTRACT

- A. Minor Change Form
- B. Change Proposal Request Form
- C. Clarification
- D. Construction Change Directive
- E. Warranty Work Request
- F. Change Order Form
- G. Claims for additional time since last meeting (weather delays, etc.)

VII. SCHEDULE, SITE OPERATIONS SET-UP AND MOBILIZATION

VIII. DISCUSSION

IX. LIEN RELEASE LOG AND BACKCHARGE LOG REVIEW

X. CLOSEOUT REQUIREMENTS

MEETING ADJOURNMENT

PROJECT:

CONSTRUCTION GUIDELINE REQUIREMENTS

The Construction Guideline Requirements supplement the project documents and procedures established for the cooperation and coordination between the Contractor, Architect, and related activities scheduled throughout the construction project.

I. RECORD DOCUMENTS AT JOB SITE

- A. The Contractor shall maintain throughout the construction of the project a record set of documents at all times secured to the document table. These plans shall be updated to reflect any changes to the original drawings. Field clarifications, minor changes, addenda, and change orders are to be posted and/or noted on these drawings to document the actual project record conditions.
- B. The Contractor, at all times, shall maintain a record set of project specifications reflecting the information noted in Item 01.

II. TESTING PROCEDURES

- A. The Testing Laboratory shall be scheduled through the General Contractor to monitor the soils, concrete, rebar, structural steel, and other testing services required throughout the project. The General Contractor will be required to provide a 48-hour advanced notice to the testing laboratory for scheduled inspections.
- B. Concrete pours shall be scheduled by the General Contractor 48 hours in advance of the scheduled pour. The General Contractor will be responsible for scheduling both Architect's representative and the testing laboratory for observation and testing of the scheduled concrete pour. Unless prior approval has been arranged, all concrete pours are to be made in the presence of the testing laboratory and/or Architect's representative, following their review of all reinforcing steel and miscellaneous items.

III. FIELD INSPECTIONS

- A. Mechanical, Electrical, and Plumbing inspections shall be in compliance with the contract documents. Excavation, materials, installation, backfill, and cover-up shall be reviewed by a representative from Architect, the Owner, and/or an outside consultant in the required sequences for each scheduled activity. The General Contractor will be required to provide a 24-hour advance notice for each scheduled activity to be reviewed.

IV. SUBMITTALS

- A. Shop Drawings and/or submittals shall be submitted to the Architect in the required quantities (re: specs), with the Contractor's stamp affixed to all items and signed by the Contractor signifying he has reviewed each submittal and it meets exceeds all Contract requirements. Shop drawings or submittals not containing this information will be returned not approved. Commencement of work without reviewed and approved shop drawings will not be permitted. The Contractor will provide a list of shop drawings and/or submittals within 1 month of contract award noting the critical and/or priority items requiring immediate review and approval. Dates for submission of all items will also be provided. A complete set of shop drawings shall be maintained at the field office and their status reviewed at each construction progress meeting.

V. CHANGES IN THE WORK

- A. Change Requests involving additions, deletions, and/or revisions to the contract documents must be submitted by the Contractor to Architect's office in writing accompanied by an itemized material, labor, and equipment breakdown for review and approval prior to any changes occurring. Response to all minor changes and proposal requests must be submitted to Architect within 20 days for review and response.

VI. LIST OF SUBCONTRACTORS

- A. A list of each Subcontractor scheduled to perform work on the project should be submitted to Architect at the start of the project with Schedule of Values and before review of the first Application for Payment. (Use AIA Document G805)
- B. Prior to the commencement of work by each Subcontractor, a meeting will be scheduled to review the requirements, materials, and/or equipment specified in the contract documents.

VII. SCHEDULE OF VALUES

- A. The Schedule of Values shall be approved by Owner and Architect prior to submitting the first pay application. This Schedule shall include the monetary values for each item of construction, breaking out the labor and material for each activity. (Use AIA Documents G702 and G703)

VIII. PROGRESS SCHEDULE

- A. Progress Schedules shall be approved by Owner and Architect prior to submitting the first pay application. This schedule shall be a graphical projection of construction activities subdivided into various components and outlining the anticipated starting and completion dates. Indicate the "critical path" items and update the schedule monthly and recovery if required.

IX. CONTRACTOR'S APPLICATION FOR PAYMENT

- A. Pay applications will be reviewed monthly at the project site. The pay application will be in a preliminary draft for the review by Architect's and the Owner's representative. The reviewed, accepted, and/or modified pay application will be submitted to Architect's office for processing. Affected subcontractors and/or material suppliers are requested to be present at each pay application review. Progress schedules are to be revised and updated monthly and submitted with each preceding application for payment.
- B. Stored materials are required to be in accordance with Section 9.3.2.

X. PROGRESS MEETINGS

- A. Progress meetings will be held to discuss job progress, coordination, schedule, and anticipated conflicts. Those in attendance will be the Owner, Architect, General Contractor, affected subcontractors, and/or particular consultants. Frequency of the progress meetings will be determined by job conditions. The Architect will keep accurate minutes of the meetings and distribute copies to all in attendance.

XI. LINES OF COMMUNICATION

- A. The Architect is the Owner's representative and all communications between the Owner and General Contractor shall be channeled through the Architect. Subcontractors shall correspond with the Owner and/or the Architect through, or in the presence of, the General Contractor.
- B. The Superintendent shall be fully knowledgeable of the contract documents. Review and approval by the Superintendent of all items prior to observations by the Architect and/or Owner's representative is essential in avoiding project delays and re-inspection of nonconforming work.

XII. ADDITIONAL SERVICES

- A. Additional architectural or engineering services and testing or retesting to analyze and inspect nonconforming work shall be at the Contractor's expense.

XIII. APPROPRIATE CONDUCT

- A. Appropriate conduct and language must be exercised by all construction workers. Appropriate clothing must be worn at the job sites by all workers. Misconduct involving a worker will constitute immediate dismissal and removal of said worker from the project site.
- B. The Contractor shall comply with all Special Owner Requirements per Specification Section 01 35 23 herewithin.

XIV. SUBSTITUTIONS

- A. Substitutions not approved prior to proposal will not be considered.

XV. SUBSTANTIAL COMPLETION AND CLOSE OUT

- A. The General Contractor shall submit in written form a list of items requiring completion (per contract requirement) and/or correction along with a written request for substantial completion.
- B. The General Contractor shall submit all of the required documents, information, and materials to the Architect to expedite project close-out as outlined in the Project Close-Out Specifications.

PROJECT:

CONSTRUCTION TRADE START-UP MEETING GUIDELINES

The Architect shall direct the General Contractor to arrange a time and location 48 hours prior to a new trade commencing work for the purpose of reviewing and discussing the project documents and specifications governing the particular Subcontractor's work.

The reviews should include, but not be limited to, the following:

1. Determine if all appropriate shop drawings, samples, and/or literature has been submitted, reviewed, and approved.
2. Determine if the Subcontractor has all the current documents to begin and complete his work in compliance with the contract.
3. Inform the Subcontractor/Foreman that if inspections will be needed, the Contractor must provide the Architect with a 48-hour advance notice.
4. Review with the Contractor and Subcontractor any storage or temporary staging areas required and whether there will be conflicts with other trades.
5. Determine if Subcontractor/Foreman has knowledge of what area his work will commence and the sequence to be followed.
6. Examine thoroughly each part and section of the specifications, noting materials, workmanship, manufacturer's recommendations, installation, etc.
7. Alert the Contractor and Subcontractor to special conditions outlined in the project documents and/or project specifications required by the Architect, Owner, or related Consultants.
8. Emphasize that clean-up is a very important item in the overall construction of the project and that an unsightly project will not be tolerated.
9. Inquire if there are any questions relating to the specific areas covered or questions about areas not specifically covered.
10. Review coordination drawings required by Contract.

PROJECT:

JOB PROGRESS MEETING GUIDELINES

The Architect shall consult with the Owner's representative to determine at what intervals progress meetings will occur. The Architect shall inform the General Contractor of the time, date, and locations of the Construction Progress Meetings and the regularity of the proposed scheduled meetings.

ARCHITECT

1. The Architect shall prepare a Record of Attendance sign-in sheet for those attending the progress meeting.
2. The Architect shall preside over the order of the meeting. The Architect shall then recognize the General Contractor's representative, who will address the items outlined under the Contractor.
3. Following the completion of the Contractor's agenda, comments will be received and/or offered by the Owner, Architect, Contractor, and any member in attendance at the progress meetings.
4. The Architect shall submit to the Owner and Contractor notes describing the accounts of the progress meeting, including the time, date, and location of the next scheduled meeting.
5. The Architect, upon reviewing the previous meeting minutes with the Owner and General Contractor, shall amend, add to, or accept as submitted. The meeting notes will then be mailed to the Owner and Contractor for their record copy of the accepted meeting notes.

CONTRACTOR

1. The Contractor, at the beginning of each progress meeting, shall submit an agenda outlining those scheduled to attend, an updated progress schedule, and any other matters of interest requiring discussions and/or immediate response affecting the overall construction progress.
2. The progress meetings shall be attended by the Project Manager, Field Superintendent, representatives from trades in progress or trades to begin work prior to the next scheduled meeting. Materials suppliers and/or other representatives impacting the current or near-current construction schedule shall also be in attendance.
3. The Contractor shall review and update the construction schedule by noting progress, work in progress, and anticipated work to begin. Areas of delays in deliveries, materials, equipment, manpower, utilities, pending architectural responses, and/or pending Owner responses that may affect the construction progress shall be addressed in conjunction with the construction progress schedule.

END OF SECTION

NOTIFICATION OF ARCHITECT REQUIREMENTS

PART 1 - GENERAL

A. In general, the Contractor shall notify the Architect whenever there is need of clarification of interpretation of the Contract Documents.

B. The Contractor shall notify the Architect 48 hours in advance of certain stages of construction. The project superintendent shall notify the Owner's Representative on an ongoing basis of ongoing work. These stages shall include, but are not necessarily be limited to the following:

1. Division 2, Division 31 - Clearing of site.
2. Div 31-33 - Stripping of top soil within limits of grading.
3. Div 31-33 - (Excavation and) Placing (of each lift of) select fill material.
4. Div 31-33 - Compaction, inspection, testing, and covering of underground utilities.
5. 31 63 29 - Drilled and reamed foundation piers.
6. 31 23 00 - Excavation of grade beams.
7. 03 30 00, 04 22 13 - Placing of concrete.
8. 07 81 00 - Concealment of insulation.
9. 07 84 00 - Installation of firestopping and firesafing.
10. 07 52 19 - Modified Bitumen Membrane Roofing System
11. 07 92 00 - Installation of building and glazing sealants.
12. 08 80 00 - Installation of glazing and glazed systems.
13. 09 21 16 - Installation of gypsum wallboard.
14. 09 30 13 - Installation of ceramic tile.
15. 09 51 00 - Installation of acoustical ceiling (grid and panels).
16. 09 65 19 - Installation of resilient flooring and base.
17. 09 68 00 - Installation of carpeting.
18. Division 09 - Painting and staining (each coat), Elastomeric coatings, etc.
19. Division 02 - Abatement work
20. Division 23 - Installation of heating, ventilating and air conditioning system.
21. Division 23 - HVAC system startup
22. Division 22 - Installation of plumbing fixtures.
23. Divisions 21-26 - Any and all testing and training specified for equipment, mechanical, electrical and plumbing systems.
24. Divisions 21-26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
25. Division 26 - Initiation of permanent power
26. Division 26 - Installation of all electrical fixtures.
27. Division 27-28 - Installation of all data, low voltage, security, special systems, fire alarm, and misc. technology systems.
28. Notify the Architect and the Owner: All pre-construction or trade startup meetings.
29. Owner shall be given notification/opportunity to conduct inspections prior to wall or ceiling cover up.

C. In addition to notifying the Architect, the Contractor shall also notify the Structural Engineer (48 hours) prior to the following stages:

1. Drilling, reinforcing, and placing of first piers and footings.
2. Placing first reinforcing and grade beams.
3. Erecting structural steel elements.

- D. Above ceiling inspections shall be completed prior to cover up. All systems are to be reviewed at the same inspection. All systems shall be 100 percent complete prior to inspection.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction and/or trade startups meeting with Contractor, Architect, Owner, and third-party firms. This meeting must occur prior to commencement of any construction.

3.2 CONFERENCES AND MEETINGS

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.

1.2 SUBMITTALS

- A. Schedules:
 - 1. Preliminary Analysis: Within fourteen days after receipt of Notice to Proceed, submit a preliminary construction schedule for review.
 - 2. Construction Schedule: Within four weeks after receipt of Notice to Proceed, submit one reproducible and four prints of the construction schedule.

1.3 RELIANCE UPON SCHEDULE

- A. The construction schedule as approved by the Architect will be an integral part of the Contract, and will establish conditions for various activities and phases of construction.

PART 2 - PRODUCTS

2.1 CONSTRUCTION SCHEDULE

- A. Diagram: Graphically show the order of all activities necessary to complete the work and the sequence in which each activity is to be accomplished.
- B. General Requirement:
 - 1. Contractor shall provide a completed Project Schedule as outlined below 14 days after Contract Award for review and comment by Owner and Architect
 - 2. Activities shown on the schedule shall include, but not necessarily be limited to:
 - a. Project mobilization.
 - b. Submittals and approvals of shop drawings and samples.
 - c. Phasing of construction.
 - d. Procurement of equipment and critical materials.
 - e. Fabrication and installation of special material and equipment.
 - f. Final clean-up.
 - g. Final inspection and testing.
 - h. Air and water balancing.
 - i. Demonstrations for Owner and Owner's staff.
 - j. Punch lists.
 - k. Project closeout.
 - l. Commissioning Schedule
 - 3. The project Schedule shall be divided by trade/spec section and by area of the building with each section to include such items as material delivery dates, below-grade finish/install, above-grade finish/install, trimout, etc. Detail to include specific components of the trade being scheduled (for example: painting would show clean/prep. Block fill, first coat, finish coat, etc.).

4. Project Schedule shall include the amount of anticipated weather days allocated for the Project at the appropriate months, and should also include such milestones as permanent power, chiller startup, etc. where applicable.
5. Contractor shall complete the subcontract trades buyout process 30 days after the Contract award.
6. Contractor shall ensure that all required submittals are submitted for review no later than 60 days after Contract award.
7. Project schedule shall be initially scheduled to allow Initial Completion 60 days prior to Substantial Completion. The 60-day period between Initial Completion and Substantial Completion shall be allocated for such items as the following:
 - a) *Initial Final Clean*
 - b) *Trial owner's systems testing*
 - c) *Owner's tests and inspections*
 - d) *Owner's systems demonstrations*
 - e) *Establishment of required stand of grass*
 - f) *Correction of Contractor's punch list*
 - g) *Owner/Architect punch list*
 - h) *Correction of Owner/Architect punch list*
 - i) *Final clean to deliver building after all tests and inspections*
 - j) *Substantial Completion*
 - k) *Test and Balancing*
 - l) *Commissioning*
8. Schedule shall also include a review of O&M manuals 30 days prior to Substantial Completion and shall include submission of a closeout document binder mock-up.

2.2 CONSTRUCTION SCHEDULE LIMITATIONS

- A. Work performed under this Contract shall be performed in accordance with the following paragraphs so that the Owner can accept the project as substantially complete as noted below.
- B. The project schedule begins upon Notice to Proceed and continue uninterrupted with the following requirements:
 1. The entire project shall be substantially complete by dates noted in the Standard Form of Agreement between Owner and Contractor (AIA Document A101™-2017, as amended) subject to Liquidated Damages as listed in General Conditions of the Contract for Construction as amended (AIA Document A201™-2017, as amended) and Supplemental Conditions (Section CB).
- C. Certificates of Substantial Completion may be issued for any of the above mentioned areas of work which are complete prior to the completion of the entire project, provided that all contract requirements for Substantial Completion are met for that portion of the Work. However, warranties shall commence on date of Substantial Completion of entire project. Maintenance required by equipment manufacturers shall be performed by Contractor through the agreed-upon Substantial Completion date, unless specified otherwise in the Contract Documents.
- D. For work during Summer: Any construction related activities after (Last Day of School) and before the start of the next school year, must occur during CFISD normal working hours of Monday through Thursday (10-hour days) or the contractor must request and pay for overtime request to have the building open per Special Owner Requirements Section 01 35 21.1. This requirement will also apply to any work during the school year outside the normal CFISD working hours. The 4-day/10-hour day schedule will only be applicable during scheduled summer break.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Section AB for substitutions.

1.2 PROCEDURES

- A. Transmit each item with approved form identifying project, contractor, subcontractor, major supplier; identify pertinent drawing sheet and detail number and specification section number, as appropriate. Identify deviations from Contract Documents.
- B. Apply Contractor's stamp, signed, to each item submitted, certifying that review and verification of products, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
- C. Revise and resubmit submittal as required; identify all changes made since previous submittal.
- D. After review, distribute copies to all concerned parties.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- A. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended, 3.12.13 for the number of copies required. Transmit Consultant and Engineering submittals directly to respective consultants with a transmittal to the Architect.
- B. The Contractor shall provide composite drawings within 4 weeks of Notice To Proceed, showing how all piping, ductwork, lights, conduit, and 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 1/4 inch per foot minimum scale and shall include invert elevations and sections required to meet the intended purpose.
- C. Manufacturer's Instructions: When work is specified to comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect at least two weeks prior to start of such work.
- D. All dimensions indicated on the drawings are based on the specific models and manufacturers of products, equipment, fixtures, and miscellaneous items specified. If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these specifications, then the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings, and miscellaneous items. When dimensional changes are required in these situations, the Contractor shall submit a proposed modification drawing to the Architect for approval prior to proceeding with the work. All causes and effects of the dimensional change shall be indicated on the Contractor's drawing submittal.

1.4 SAMPLES

- A. Submit full range of manufacturer's standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other Contractor. All color samples to be physical samples, not digital unless requested by Architect.

- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- C. Submittals shall contain:
 - 1. Date of submission and dates of any previous submissions
 - 2. Project title and number
 - 3. Contract identification
 - 4. Names of Contractor, Supplier, Manufacturer
 - 5. Identification of sample, with specification section number
 - 6. Note any deviation from contract documents
- D. Resubmission Requirements for Samples:
 - 1. Make any corrections or changes in the submittals required by the Architect and resubmit until approved.
 - 2. Submit new samples as required for initial submittal.
- E. Submit the number specified in the respective Specification section; minimum of two, one will be retained by Architect. Reviewed samples may be used in the work if so indicated in the specification section.

2. MANUFACTURER'S CERTIFICATES AND WARRANTIES

- A. Submit required certificates and warranties in duplicate.

END OF SECTION

SECTION 01 35 23

SPECIAL OWNER REQUIREMENTS

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

1. **Substantial Completion: Refer to the General Conditions of the Contract for Construction as amended, Paragraph 9.8.**
2. **Documentation of Existing Conditions**
 - a. Conditions of improvements (roads, landscape areas, signage, building exterior and interior, etc.) at the building site where work is scheduled to occur are considered to be in good condition. The Contractor shall document through the use of digital video, any existing defects in areas where work will actually be performed, including but not limited to, staging areas and areas of circulation around the site, prior to the start of any construction. Contractor shall also test and document building and site systems (fire alarm, sound, irrigation, etc.) These systems are considered to be in good operating condition unless documented otherwise. A copy of all digital video (flash drive) must be filed with the Owner prior to the start of any construction. Any and all defects not specifically identified prior to construction shall be repaired/replaced by the contractor to the satisfaction of the Owner, at no additional cost.
3. **Application for Payment:**
 - a. Pay application(s) must be correctly completed and executed by the Contractor. All numerical columns and tabulations should be correctly totaled to the nearest cent. With each pay application, Contractor shall also submit partial lien releases from all sub-contractors and major suppliers on the form included in this Project Manual, for work performed through the previous accounting period, an updated construction schedule and construction progress photographs. All lien notices received by the Owner from the previous pay period must be cleared by submission of an unconditional release of lien prior to submission and approval of current applications for payment. Noncompliance with these requirements will result in the return of the Application for Payment(s) to the Contractor for correction and resubmittal. Final application for payment shall only be submitted to the Owner upon completion of all close out requirements including but not limited to receipt of Record Documents, Operation and Maintenance Manuals, Owner Orientation and Training Meetings, Consent of Surety, Contractor Final Release of Lien, Contractor's Affidavit of Payment of Debts and Claims, and unconditional final lien releases from all subcontractors, sub-subcontractors and major suppliers and any other closeout requirements per the contract documents.
 - b. **If errors are discovered by the Owner in certified applications for payment, the Owner shall reject the application and return it to the contractor for correction. The specified time period for payment of such applications will start over on the date the Owner receives the corrected certified application for payment from the Architect.**
4. **Construction Schedule:**
 - a. Refer to Section 01 32 16. The Contractor shall provide a detailed construction schedule at the start of the project and shall submit an updated schedule at the weekly construction meetings. This schedule will also identify the estimated percentage of work completed to date for each item of work along with percentage of work remaining to be completed. This information will be used in the verification of the Contractor's Application for Payment. Application for Payment will not be reviewed, approved, and processed without submittal of the initial schedule and subsequent updated schedules throughout the duration of the project.

5. Use of Alcohol and Tobacco Products:

- a. Smoking and the use of all tobacco and alcohol products are prohibited at all times on Cypress-Fairbanks ISD property, including the field office. The Contractor will be fined \$250.00 for each infraction of this policy. In addition, the Owner reserves the right to have the Contractor's personnel dismissed from the District property. This policy is strictly enforced by all employees of Cypress-Fairbanks ISD.

6. Reinspection Fees:

- a. During the course of the project, should additional inspections be required by the Owner or Consultants to review problems directly created by and attributable to the Contractor, then all associated expenses including mileage shall be deducted from funds remaining to be paid to the Contractor. The Owner or Architect will verbally inform the General Contractor of the intent to request additional reinspection fees at the time of the occurrence and will provide written invoicing within thirty (30) working days after the date of the occurrence.

7. Job Superintendent:

- a. The Contractor will be required to keep the job superintendent on the job site full-time during the course of the job until completion of all punch list items. In the event the job superintendent is absent from the job site at any time during the project contract time or during punch list completion and a previously agreed upon substitute is not provided, the Owner may fine the Contractor \$250.00 per occurrence.
- b. The Owner is to be notified at the beginning of the workday if the job superintendent is out sick. If the superintendent is out for any other reason, the Owner is to be notified at least twenty-four (24) hours in advance. In both cases, the Owner is to be informed of the name of the acting job superintendent.
- c. Subcontractors, Sub-subcontractors are not allowed to work unsupervised on the jobsite at any time during the performance of the work including overtime and weekends.
- d. Where multiple sites are part of the construction contract, the Contractor shall furnish a full-time superintendent for each project campus work is to be performed unless otherwise specified or agreed to by the Owner.

8. Site/Building Rules and Regulations

- a. The Contractor shall adhere to the following building rules and regulations during the performance of the work within this contract. The Owner will back charge the Contractor in the amount of \$250.00 per occurrence for any violations of any of these rules and regulations. In addition, the Owner reserves the right to remove the person committing the violation permanently from the project site.
 1. No foul language or spitting will be allowed on district property and within the interior of the buildings.
 2. The possession of tobacco products, firearms, alcohol, or illegal drugs is strictly prohibited on school property and is a state and federal law and subject to criminal charges for any such violation.
 3. Workers must be fully clothed. Shorts and tank tops are not allowed on school property.
 4. The Contractor's personnel shall demonstrate professional behavior and respect toward all school district personnel and property. Physical, verbal, or visual contact with students is strictly prohibited.
 5. Any worker with a history of felony convictions or warrants is strictly prohibited from working on district property. The District has the right to perform criminal checks on any worker the Contractor and/or its subcontractors proposes to use on the project prior to

- issuance of security identification badges. The Owner reserves the right to check such records anytime during construction if the Owner deems it necessary for the safety and protection of the students and staff.
6. The Contractor's personnel are not allowed to park on any grass area, under shade trees, sidewalks, or non-vehicular paved areas. The Contractor will be held liable for any resultant damages resulting from the violation of this requirement.
 7. Authorization must be obtained in advance with the campus administrator or the Facilities Planning and Construction Department to enter or access any existing facility campus.
 8. The Contractor, subcontractors or sub-subcontractors shall keep the premises and site free from accumulation of waste, materials or rubbish caused by the work under this contract at each site. Boxes must be broken down prior to removal from the building. Upon completion of the contract work, and prior to the final inspection, have the premises in a neat and clean condition.
 9. The Contractor shall take all precautions necessary for the safety of, and provide protection to prevent damage, injury or loss to:
 - a. All employees on the project and all other persons who may be affected thereby.
 - b. All the work with all the materials to be incorporated therein, whether in storage on or off the site.
 - c. All property at the site and adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and any other school property.
 10. A competent supervisor who understands the full scope of the work shall be on-site at all times while work is being performed and remain on-site until all punch list items have been completed as specified here within this specification section.
 11. The Contractor shall be responsible to Cypress-Fairbanks I.S.D. for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the work under the contract.
 12. The Contractor shall not perform any work within the confines of a secured building on a renovation/addition project or after Substantial Completion on a new Project without the District having one District custodian present during performance of the work. The contractor must reimburse Cypress-Fairbanks I.S.D. Operations Department for the overtime costs associated with the after-hours work as specified within this specification section. Refer to Special Owner Requirements Overtime Section 01 35 23.1.
 13. All exterior doors must be kept closed at all times.
 14. All workers must wear badges at all times when on CFISD property. Refer to Special Owner Requirements Badging Section 01 35 23.2
 15. All deliveries shall be received and signed for by the Contractor and not by Cypress-Fairbanks ISD personnel. The Contractor shall post signs, in a location agreed upon by the Owner's Representative, stating where deliveries are to be received and who is to sign for them.

Signature form follows on next page.

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents, and read the Specifications including the General Conditions as Amended, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By: _____
Signature

Printed Name

Title

Company Name

Street Address

City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date _____ State of _____ County of _____

Subscribed and sworn to before me this _____ day of _____

Notary Public:

My Commission expires:

NOTE: Form must be notarized and attached to the Construction Contract.

END OF SECTION

SECTION 01 35 23.1

**BUILDING OVERTIME REQUESTS
SPECIAL OWNER REQUIREMENTS**

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

Contractor Overtime and Building Access

- A. Owner's building personnel will be present at all times during the performance of the Work by the Contractor should Work be necessary during non-normal hours, weekend, School District employee Holidays and after the date of substantial completion. If the Contractor needs access to the sites other than normal campus working hours, notification shall be provided to the Owner's Representative through the Facilities Planning and Construction Office Project Manager. The attached "Contractor Overtime Building Access Request Form" within this section shall be submitted for all overtime requests to obtain Owner approval.
- B. Overtime requests/scheduling: Contractor shall request with the attached form and submit by noon, a minimum of three (3) days in advance of the anticipated Work an overtime request. These requests shall be a minimum of four (4) hour charge. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for paying the total requested overtime hours billing. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building as well as 30 minutes for lunch.
- C. The Contractor shall compensate the Owner at the rate of twenty-two (\$22.00) dollars per hour for non-normal and weekend hours, and thirty-three (\$33.00) dollars per hour for School District employee Holidays.
- D. Overtime cancellations: Contractor shall request and submit by noon, a minimum of two (2) days in advance of the anticipated Work an overtime cancellation request should scheduled work and overtime not occur. If Contractor fails to cancel, they will be charged the four (4) hour minimum charge.
- E. Invoices will be submitted by the Owner to the Contractor on a monthly basis and are payable upon receipt to Cypress-Fairbanks I.S.D. Operations Department. Payment must be received within thirty (30) days of the invoice date. Owner reserves the right to refuse future overtime requests as well as the rejection of any current application for payment until such time outstanding payments are received.
- F. Hours:
 - 1. Normal School hours: 6:30 AM – 11:30 PM Monday – Friday
 - 2. Summer hours: 6:00 AM – 4:30 PM Monday - Thursday
 - 3. Not including District recognized employee Holidays per academic year calendars on District's website:
Spring Break Week, Thanksgiving Week and Winter Break
6:00 AM – 2:30 PM
 - 4. Food Production, school kitchens:
 - Elementary 7:00 AM – 3:30 PM for most, verify with Owner
 - Middle 6:30 AM – 3:00 PM for most, verify with Owner
 - High 6:00 AM – 2:30 PM for most, verify with Owner
- G. Package renovation and construction projects containing multiple district campuses will require overtime requests/cancellations be submitted for each building as needed.
- H. Overtime agreements made that differ from the above noted guidelines will not be accepted or honored.
- I. For site work only, the Contractor is required to complete the overtime form and submit it to the District. There will be no charge for site work only to the Contractor. The District will notify all parties to inform them work is being scheduled to be performed on our site.

Signature page continued below.

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents and read the Specifications including the General Conditions as Amended, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By: _____
Signature

Printed Name

Title

Company Name

Street Address

City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date _____ State of _____ County of _____

Subscribed and sworn to before me this _____ day of _____

Notary Public:

My Commission expires:

NOTE: Form must be notarized and attached to the Construction Contract.

Section 01 35 23.2

Special Owner Requirements - Badging Process

For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Refer to enclosed instructions and Form AP packet for necessary submission information and procedures.

1.1 SECTION INCLUDES

- A. This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign these documents and an original, notarized copy will be attached to the Construction Contract.
- B. Mandatory photo identification badge with the workers name and name of the Construction Company, which shall be worn at all times *[required after Substantial Completion for new buildings; required at all times for renovations]* shall be provided by the Owner and payable by the General Contractor. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. The Owner reserves the right to reject issuing a security badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site. Back charges are applicable for any infraction of this requirement.
- C. Lists must be forwarded to the Facilities Planning & Construction Department 72 hours or earlier in advance of going to the site.
- D. List shall be submitted on forms contained in Form AP packet.
- E. Should a Contractor want to add names to their original list, they must be added on a separate list.
- F. A maximum of 5 groups of **3-4 workers** may report to the Facilities Planning and Construction Department to have photos taken and pick-up the identification badges, based upon the agreed upon schedule. If more than the maximum number of workers show up, they will be asked to wait, or to return at a later time.
- G. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date, but not longer than one year from date of issuance. Upon expiration, the contractor shall repeat the application process. There is no charge for renewal badges provided that the worker returns his previous badge. Otherwise, the \$10.00 charge applies.
- H. Badges must be worn at all times by all General Contractor, Subcontractor or Sub-subcontractor personnel on school district property during the construction of the project.
- I. The Contractor will be invoiced by Facilities Planning, & Construction and will be responsible for payment within 30 days of the invoice date.
- J. Should a person lose a badge and need a replacement, this procedure will be used to obtain the replacement badge. A \$10.00 charge for the replacement badge will be applicable for all lost badges.
- K. The Contractor shall contact Facilities Planning, & Construction with any questions during the process. The Contractor shall not contact Cypress-Fairbanks Police Department directly.

- L. Contractor shall return all project badges to CFISD. This included but is not limited to the Contractor, Sub-contractor, sub-sub-contractor, etc. Should badges not be returnable, Contractor shall submit letter in writing noting badges are lost for CFISD records as well as be assessed a fee of \$10.00 for each badge not returned to CFISD. If Contractor fails to pay such fees, the Owner will deduct such charges from the final payment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

- 3.1** Refer to and follow the attached instructions.

END OF SECTION

SECTION 01 36 13

RENOVATION PROJECT PROCEDURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. This Section contains general provisions and requirements pertaining to all remodeling, removal, and relocation of Work in the existing building and becomes a part of each Section and Division performing remodeling, removal and relocation Work for this Project with the same force and effect as if written in full therein.
- B. Take all necessary precautions to keep students and other trespassers out of the Work areas. Secure Work areas from entry when Work is not in progress.
- C. Perform all alterations, remodeling, demolition, removal and relocation of Work in strict accordance with Owner's instructions and applicable Federal, State and local health and safety standards, codes and ordinances. Where conflicts occur, the more restrictive requirement shall govern.
- D. Refer to section 01 71 50 Preventive Housekeeping and Final Carpet Cleaning.

1.2 RELATED WORK

- A. Section 02 41 01 - Demolition

1.3 EXISTING CONDITIONS

- A. Obvious existing conditions, installations and obstructions affecting the Work shall be taken into consideration as necessary Work to be done, the same as though they were completely shown or described.
- B. Items of existing construction indicated to remain upon completion of the Contract, but which require removal to complete the Work, shall be carefully removed and replaced as required. The replaced Work shall match its condition at the start of the Work unless otherwise required.
- C. Visit the site to determine by inspection all existing conditions, including access to the site, the nature of structures, objects and materials to be encountered, and all other facts concerning or affecting the Work. Information on the Drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered.
- D. Utilities: Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Architect/Owner in writing two (2) weeks in advance. Provide temporary services during interruptions to existing utilities.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

- A. The Owner reserves the right of first refusal on all salvage items. Remove remaining items from the site as Work progresses. Storage or sale of items on site is not permitted. Burning or burying of removed materials on site is not permitted.

- B. Store salvaged items in a dry, secure place on site.
- C. Salvaged items not required for use in repair of existing Work shall remain the property of the Owner.
- D. Do not incorporate salvaged or used material in new construction except where specified in the Contract Documents

2.2 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

- A. Contract Documents do not define products or standards of workmanship present in existing construction. Determine products by inspection and by use of the existing. Provide same or similar quality products or types of construction as that in existing structure when needed to patch or extend existing Work.
- B. If reasonably matching products are not obtainable, improve appearance by minor relocating of some existing products and grouping new ones in some pattern arranged by the Architect.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK TO REMAIN

- A. Protect existing Work from damage. Use barricades, tarpaulins, temporary walls, plywood, planking, masking, or other suitable means and methods as approved by the Architect.
- B. If Work to remain in place is damaged, restore to original condition at no additional cost to the Owner.
- C. Concealed Conditions: If conditions cause changes in the Work from requirements of the Contract Documents, the Contract Sum will be adjusted in accordance with the General Conditions.

3.2 PROCEDURES

- A. Refinishing At Removed Work: Cut below surface of substrate materials and patch over area of removal with finish materials so removal is not apparent.
- B. Remove and replace existing ceilings, and cut, patch, or replace existing walls, partitions and floors as may be necessary for access to valves, piping, conduit and tubing by mechanical and electrical trades as directed and approved by the Architect, and performed by the appropriate subcontractor for the Work involved, or by other properly qualified subcontractors.
- C. Patch and extend existing Work using skilled mechanics who are capable of matching existing quality and workmanship. Quality of patched or extended Work shall be not less than that specified for new Work.
- D. Cutting:
 - 1. Concrete and Masonry: Saw cut where feasible.
 - 2. Plaster: Cut back to sound plaster on straight lines, and back-bevel edges of remaining plaster. Trim and prepare existing lath for tying of new lath.
 - 3. Woodwork: Cut back to a joint or panel line. Undamaged removed materials may be reused.
 - 4. Resilient Tiles: Remove in whole units to natural breaking points or straight joint lines with no damaged or defective existing tiles remaining where joining new construction.
 - 5. Salvaged Materials: Carefully remove to avoid damage, thoroughly clean and reinstall as indicated, or as directed.

6. Doors: Remove in such a manner as to facilitate filling in of openings or installation of new Work, as required by Drawings. **Refer to Finish Hardware Section for specific requirements for salvage of existing finish hardware.** Provide construction cores as required to maintain security and access control.
 7. Structural Elements: Remove only as shown on the Structural Drawings. If not specifically shown, but removal is required, perform such removal or alteration only upon written approval of the Architect. Do not damage or alter any structural element of the existing building.
- E. Patching:
1. Match existing Work where possible; if unavailable, use salvage material for patching and provide totally new material in areas where salvage has been removed; consult with the Architect concerning locations for salvaging materials.
 2. Repairs or continuations of existing Work shall be relatively imperceptible in the finished Work when viewed under finished lighting conditions from a distance of six (6) feet.
 3. Patching, Repairing and Finishing of Existing Work: Perform in compliance with the applicable requirements of the Specification Section covering the Work to be performed and the requirement of this Section.
- F. Erect scaffolding as necessary to gain access to the various parts of the Work. Provide structurally sound, rigidly braced and properly constructed scaffolding, shoring, and bracing as necessary to positively protect the affected elements and building, and to support the activities or workmen and loads. Design and construction of scaffolds and supports shall be in accordance with applicable safety regulations. Material used shall be adequate to support anticipated loads with a properly calculated margin of safety.
- G. Noise Producing Equipment: Minimize use of noise producing equipment. Limit excessive noise to periods of vacancy or provide sound control. Arrange schedules in advance with the Architect and Owner.

3.3 EXISTING FURNITURE AND EQUIPMENT

- A. Owner Salvaged Items: Personal items in areas subject to remodeling will be removed by Owner before construction in those areas commences. Contractor shall notify Owner if any personal items remain; Owner shall remove such items.
- B. Furniture Items - Renovation: Contractor shall be responsible for any furniture relocation, storage, and move-back necessary to complete scope of work. Contractor to coordinate activities with Owner. Contractor is solely responsible for protecting furniture and equipment and is therefore solely responsible for any damage to said items and ensuing costs in restoring damaged items to same condition or replacing lost or damaged items beyond repair, unless specified as an allowance (Section 01 21 00).

3.4 PAINTING

- A. Preparation: Prepare patched areas as required for new Work. Wash existing painted surfaces with neutral soap or detergent, thoroughly rinse, and sand when dry.
- B. Painting and Finishing: Conform to the applicable provisions of the Painting Section. Prepare bare areas and patches in existing painted surfaces with specified primer and intermediate coats, sanded smooth and flush with adjoining surfaces.

3.5 DISPOSAL OF DEBRIS

- A. Remove daily material, debris and rubbish resulting from Work of this Section from the building and site as it accumulates. Keep all areas of Work in “broom clean” condition as the Work progresses.

3.6 JOB SUPERINTENDENT

- A. If renovation project includes Work at more than one site, Contractor shall have supervision at all sites as follows:

Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC shall have at least one full-time Superintendent.

Campbell MS, Cy Ranch & Jersey Village HS and Berry ESC shall have at least one full-time Assistant Superintendent.

3.7 FINAL CLEANING

- A. At completion of renovation and remodeling Work in each area, provide final cleaning of all surfaces and return all areas affected by construction to a condition suitable for use by the Owner. Final cleaning shall include dusting of all surfaces; thorough cleaning of all surfaces including the removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, lint, discolorations, and other foreign materials; vacuuming of carpets; cleaning of all new carpeting by manufacturer-approved contractor; wet-mop cleaning of tile, and waxing of VCT, terrazzo surfaces per CFISD-approved methods. Refer to section 01 71 50 for Preventive Housekeeping and Final Carpet Cleaning.

END OF SECTION

SECTION 01 36 13.1

CUTTING AND PATCHING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Execute cutting (including excavating and backfilling), fitting or patching of the work, required to:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of the contract documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Install specified work in existing construction.
- B. In addition to contract requirements, upon written instruction of the Architect:
 - 1. Uncover work to provide for observation of covered work.
 - 2. Remove samples of installed materials for testing.
 - 3. Remove work to provide for alteration of existing work.
- C. Do not endanger any work by cutting or altering the work or any part of it.
- D. Do not cut or alter the work of another Contractor without written consent of the Architect.
- E. Prior to cutting that affects structural safety of the project or the work of another Contractor, secure written approval of the Architect.

1.2 PAYMENT FOR COSTS

- A. Costs caused by ill-timed or defective work or work not conforming to the contract documents, including the cost of additional services of the Architect, Third-Party Consultants, and Owner, will be borne by the Contractor.
- B. Work done on written instructions of the Owner or Architect, other than defective or nonconforming work, will be paid by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials required for replacement of the work removed must conform to the specifications for the type of work to be done.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Provide shoring, bracing and support as required to maintain the structural integrity of the project.
- B. Provide protection for other portions of the project.
- C. Provide protection from the elements.

3.2 PERFORMANCE

- A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.
- C. Execute excavation and backfilling by methods which will prevent damage to other work and will prevent settlement.
- D. Restore work which has been cut or removed; install new products to provide complete work in accordance with requirements of the contract documents.
- E. Refinish entire surfaces as necessary to provide an even finish. On continuous surfaces, refinish to the nearest intersections. For an assembly, refinish the entire item.

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality Assurance: Requirements for material and product quality and control of installation
- B. Tolerances
- C. References and Standards
- D. Mock-ups
- E. Testing Laboratory Services
- F. Inspection Services
- G. Manufacturers' field services

1.2 RELATED SECTIONS

- A. Section 01 41 00 - Regulatory Requirements
- B. Section 01 45 23 - Testing and Inspecting Services
- C. Section 01 33 00 - Submittal Procedures
- D. Section 02 32 00 - Geotechnical Report
- E. The work of this Section shall be included as a part of all Sections of work, whether referenced therein or not.

1.3 DESCRIPTION OF REQUIREMENTS

- A. Unless specifically noted otherwise, perform all work shown, mentioned, or reasonably inferred and comply with all work restrictions.
- B. Many of the requirements specified elsewhere are included herein for reference and convenience. Where a conflict occurs between the Contract Documents, either within themselves or each other, the more stringent requirement or the most expensive combination of materials and workmanship shall prevail.
- C. Contractor shall:
 - 1. Perform work in accordance with the General Conditions, as specified herein, and with the quality control requirements of each Specification Section.
 - 2. Perform work in the highest quality workmanship, unless specified otherwise.
 - 3. Join materials with a uniform and accurate fit so they meet with neat straight lines, free of smears, overlaps or irregularities, as applicable to the work.

4. Install all exposed materials appropriately level, plumb, and at accurate angles as shown and flush with adjoining materials.
5. Attach materials with sufficient strength, and with number and spacing of fasteners and attachments that will not fail until materials joined are broken or permanently deformed.
6. Use concealed fasteners, unless shown or directed otherwise.

1.4 QUALITY ASSURANCE AND 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 manufacturer's instructions conflict with Contract Documents, request clarification from Architect/Engineer 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. Perform work 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, or disfigurement.

1.5 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES AND STANDARDS

- A. For products or workmanship specified by association, trade, or other consensus 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 by date of issue current on date of Owner-Contractor Agreement except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with contract documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, responsibilities of parties in contract nor those of Architect/Engineer shall be altered from contract documents by mention or inference otherwise in reference documents.

- F. Refer to Section 01 41 00, Codes, Regulations and Standards, for additional information concerning applicable reference and standards requirements.

1.7 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be the comparison standard for remaining work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect.
- E. Mock-up may be approved in phases as portions are completed.
- F. Project Mock-up Requirements: Provide an actual sample mockup wall with multiple panels with the following properties:
 - 1. Size: Minimum 8 feet wide by 8 feet tall. Size may vary according to specific project requirements. Brace and support as required to withstand structural windloads.
 - 2. Materials: actual exterior finishes including, but not limited to face brick, cast stone, and plaster, actual building materials and assemblies indicating brick patterns on masonry and stud back-up as occurs with dampproofing and flashing as detailed, actual portion of aluminum storefront indicating jam, sill and head attachment and flashing details, and where appropriate, provide mock-up of special finish details, insets and reliefs, reveals, expansion and control joints, brick ledges, brick head and sills, pipe penetrations and waterproofing materials. Provide roof edge flashing and gutter section (as applicable) in pre-finished color as selected by Architect to cap the mock-up panel. Include a sealant joint at least 16 inches long. Brick and Mortar color shall be selected by Architect prior to mock-up assembly.
 - 3. Drawing: Refer to mock-up diagram on Drawings for minimum project requirements. Mock-up drawing is for reference only. Actual mock-up drawing will be submitted by the Architect after submittals have been approved.

1.8 TESTING SERVICES

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform testing.
- B. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required.

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- F. Testing does not relieve Contractor to perform work to contract requirements.
 - G. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.
 - H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning testing, and submittal procedures and requirements for Testing Reports.

1.9 INSPECTION SERVICES

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform inspection.
- B. The independent firm will perform inspections and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating inspection observations and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.
 - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
- G. Inspecting does not relieve Contractor to perform work to contract requirements.
- H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning inspections, and submittal procedures and requirements for Inspection Reports.

1.10 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 required, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer within ten (10) days after receipt of Notice to Proceed, in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 33 00, Submittal Procedures, for additional information concerning submittal procedures and requirements for Manufacturers Field Reports.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify 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. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 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 new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 29

INSPECTION AND TESTING LABORATORY SERVICES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION (refer to Document AB for substitutions).

- A. All third-party inspection and testing laboratory services will be provided and paid for by the Owner or by allowance in this contract. An inspection and testing lab will be selected by the Owner and the Contractor will be notified as soon as possible.
- B. The Owner will pay for the initial inspection and testing laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for re-inspection and re-testing of materials that do not comply with the requirements of the Contract Documents, and for re-inspection and re-testing due to “no-shows” and cancellations by Contractor or Subcontractors.
- C. The Contractor shall coordinate and cooperate with the inspection and testing laboratory in all matters pertaining to the work. The Owner retains the option to add to or delete any or all inspection and testing specified herein.
- D. The third-party inspection and testing laboratory services are for the Owner’s benefit. These services shall in no way relieve Contractor of Contractor’s responsibility to provide quality control of all materials incorporated into the Work.
- E. Contractor may be subject to reimbursing owner if the Contractor’s means and methods are shown to cause an overrun in the Owner’s contract with testing lab.
- F. Prior to or during the pre-construction meeting, Contractor shall coordinate with the District’s selected testing lab in order to ensure proposal costs are not exceeded and schedule is congruent to testing proposed. Failure to coordinate may result in backcharges if overages are realized.
- G. Contractor shall submit a construction schedule at time of bid for the testing lab’s use.
- H. Contractor shall allow for in their proposal the coordination and supervision of tests to be performed by an independent laboratory as selected by the Owner.

1.2 RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals or public authorities.
- B. Respective Sections of Specifications. Certification of products.
- C. Each Specification Section Listed: Inspection and laboratory test required and standards for inspection and testing.
- D. Testing laboratory inspection, sampling and testing are required for, but not limited to the following:
 - 1. Division 31 - Earthwork
 - 2. Section 03 30 00 - Cast-In-Place Concrete
 - 3. Section 05 31 23– Steel Roof Decking
 - 4. Section 04 20 00 - Unit Masonry
 - 5. Section 05 12 00 - Structural Steel

- As requested by the Owner, Architect, or Engineer.

1.3 AUTHORITIES AND DUTIES OF THE LABORATORY

1. The Contractor shall be responsible for costs of all re-tests required to achieve passing results.
2. The Contractor shall be responsible for charges of the testing lab for expenses incurred for cancelled and/or mis-scheduled testing requests.
3. The testing lab shall invoice Contractor direct for all re-tests of failed initial tests; and send copies of the invoices to the Architect and Owner for record.
4. The testing lab and Contractor shall be responsible to negotiate and execute a separate agreement if required by the testing lab for charges described above.

1.4 TESTING LABORATORY GUIDELINES AND PROCEDURES

- concrete when scheduled concurrently at the Project site.

- D. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.
- E. Cylinders will be pick-up by the technician performing test the next day in order to have them cure under laboratory conditions.
- F. Structural steel inspections shall include a plant visit reviewing shop fabrication, welding, and an overall review of the shop fabrication quality control standards.
- G. The Contractor shall bear the responsibility of scheduling all the inspection and testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the inspection and testing services. Cancellations and or failed test will be reimbursable to the Owner by the Contractor. Contractor will provide and maintain a sign-in sheet for testing lab services.
- H. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 GENERAL

- A. Inspection and testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.
- B. Where requirements of this Section are in conflict with requirements noted on the Contract Drawings or other Sections of the Specifications, the more stringent requirement shall apply, unless directed otherwise by Architect.
- C. Should any unusual conditions be encountered during any operations, the laboratory shall be contacted immediately so that additional inspection and testing, as applicable, can be provided.
- D. The Owner reserves the right to add to or delete any or all inspection and testing specified herein.

3.2 SITE GRADING

- A. Testing Services:
 - 1. Perform field tests for moisture density properties.
 - a. In each compacted fill layer, provide one (1) field test for every 5,000 square feet of area, but not less than three (3) tests.
 - b. At paved area, provide one (1) field test for every 5,000 square feet, but not less than three (3) tests.

3.3 COMPACTING FILL AND BACKFILL

- A. Testing Services:
 - 1. Perform field test for moisture density properties:
 - a. Within the building line provide one (1) field test in each compacted layer for every 5,000 square feet of area, but not less than three (3) tests.

3.4 PAVING

A. Testing Services:

1. Perform field tests for moisture density properties:
 - a. Provide field testing of the sub-grade as described in Paragraph 3.2, A, 2 above.
 - b. Paving sub-base, provide one (1) field test for every 5,000 square feet of area of crushed limestone or caliche sub-base, if any.
 - c. Lime treated sub-grade, provide one (1) field test for every 5,000 square feet of area of lime treated sub-grade, if any, for content of lime and sub-grade compaction.
 - d. Cement soil stabilization, if any, provide one (1) field test for every 5,000 square feet of area of cement stabilized sub-grade for content of cement and sub-grade compaction.

3.5 PIPED SITE UTILITIES

A. Inspection and Observation Services:

1. Inspection of trenches for proper alignment and grade.
2. Inspection of pipe bedding and supports.
3. Inspection of pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
4. Inspection of installation of pipe and joints.
5. Observation of testing of piped utilities performed by Contractor.

3.6 EARTHWORK

A. Inspection and Observation Services:

1. Refer to and include, as applicable, work of Paragraphs 3.2, 3.3, 3.4, and 3.5 above.
2. When perimeter and underfloor drainage systems are specified or required, inspect installation of such systems for conformance with specified materials and detail requirements.
3. When temporary drainage and dewatering systems are used to keep excavations dry, inspect the systems for adequacy. Ground water should be maintained at least two (2) feet below bottom of excavation.
4. Review the equipment and methods used in placement and compaction of fill materials and inspect materials used and compaction of fills in general earthwork and in backfilling around structures, and in backfilling in utility trenches.
5. Notify the Contractor in writing and the Architect/Owner immediately if footings and slabs-on-grade are placed on unfinished soil or frozen ground and when footings and slabs-on-grade are not protected from frost damage.
6. Notify the Architect/Owner when soil with allowable bearing capacity noted is encountered at elevation above the bottom of footing shown.
7. Notify the Architect/Owner and Contractor if soil with required bearing capacity noted is not encountered at bottom of footing elevation shown. Bottom of footing shall be adjusted as recommended and approved by the Structural Engineer and Architect.
8. Review rock excavation techniques, if required, and monitor blasting induced ground motions, as appropriate.
9. Review calculations and shop drawings for sheeting, shoring, and underpinning prepared by the Contractor, if required.

B. Testing Services:

1. References (As applicable for tests):
 - a. ASTM International (ASTM)

- 1) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³))
- 2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
- 3) D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- b. American Association of State Highway and Transportation Officials (AASHTO)
 - 1) T89, Determining the Liquid Limit of Soils
 - 2) T90, Determining the Plastic Limit and Plasticity Index of Soils
 - 3) T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb.) Rammer and a 305-mm (12-in) Drop
 - 4) T238, Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth)
2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab-on-grade, and backfills.
3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material.
6. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one (1) test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
- C. Reports: Submit reports to Architect/Owner with the following information:
 1. Type and condition of soil at footing bottoms.
 2. Level of water table in the excavated areas.
 3. Grain size distribution of fill materials (average of three (3) tests).
 4. Moisture density test results.
 5. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
 6. Notify Architect/Owner by telephone within one (1) hour of the discovery of the following conditions and follow up telephone notification with written report.
 - a. Materials used, or degree of soil compaction not meeting specified requirements.
 - b. Frost and freeze protection requirements for excavation bottoms not being complied with.
 - c. Water in excavations which is not being removed prior to work being performed in excavation.

3.7 DRILLED AND UNDERREAMED (BELLED) PIERS

- A. Inspection and Observation Services:
 1. Provide full time services for the review of all drilled pier foundation inspections. Including a daily report noting grid lines and locations of each pier drilled. After the foundation shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
 2. The drilling and verification of suitable soil for bearing capacity. Notify the Architect when soil with allowable bearing capacity noted is encountered at elevation above the bottom of

pier shown. Notify the Architect and Contractor if soil with required bearing capacity noted is not encountered at bottom of pier elevation shown. Bottom of pier shall be adjusted as recommended and approved by the Structural Engineer and Architect.

- a. Drilled shaft has been drilled plumb and within specified vertical and horizontal tolerances specified by the Structural Engineer.
- b. Drilled shaft and underreamed bells are excavated to specified depths and/or if conditions differ from those presented, to notify the Structural Engineer.
- c. Drilled shaft and underreamed bell bottoms are kept dry at all times, cleaned of excess cuttings, or all obstructions prior to placing reinforcing steel and concrete. If groundwater seepage occurs, it shall be removed prior to concrete placement or controlled with temporary steel casing to maintain the shaft integrity up to the concrete placement.
- d. Concrete reinforcing steel shall be checked for type, size, adequate placement and lap lengths, and doweled bars.

3.8 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspection and Observation Services:

1. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with Contract Documents and approved shop drawings. All instances of noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and then, if uncorrected, reported to the Architect/Owner.

B. Reports:

1. Observe and Report on the Following:
 - a. Number and size of bars.
 - b. Bending and lengths of bars.
 - c. Splicing.
 - d. Clearance to forms including chair heights.
 - e. Clearance between bars or spacing.
 - f. Rust, form oil, and other contamination.
 - g. Grade of steel.
 - h. Securing, tying, and chairing of bars.
 - i. Excessive congestion of reinforcing steel.
 - j. Installation of anchor bolts and placement of concrete around such bolts.
 - k. Fabrication of embedded metal assemblies, including visual inspection of all welds.
1. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Testing Services:

1. Will be required of all suspect materials or workmanship at the discretion of the Architect, Engineer, or Owner.

3.9 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:

1. Visually inspect and report on the completed condition of each mechanical splice of reinforcing steel.

2. Each mechanical splice shall be visually inspected to ensure compliance with the I.C.B.O. reports and the manufacturer's published criteria for acceptable completed splices.
 3. Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced, as required by the I.C.B.O. Report.
- B. Reports: Submit reports to Architect with the following information:
1. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
 2. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Reasons for rejection shall be shown on each report.

3.10 CAST-IN-PLACE CONCRETE

- A. Inspection and Observation Services:
1. Review concrete design mixes proposed for use on the Project.
 2. Provide full time services for all structural building concrete in drilled piers, grade beams, slab on grade, columns, concrete paving, and other miscellaneous structural concrete. Refer to and include work for reinforcement steel specified in Paragraphs 3.8 and 3.9 above.
 3. On the first day's batching of each type and each strength of concrete, inspect and observe materials for concrete, batch weights, moisture content, and gradation of fine and coarse aggregate.
 4. Provide additional inspection if the Contractor elects to use concrete from more than one (1) source of supply simultaneously. All costs for such additional inspection shall be borne by the Contractor.
- B. Testing Services:
1. References (As applicable for field and laboratory tests):
 - a. American Concrete Institute (ACI)
 - 1) 214, Recommended Practice for Evaluation of Strength Test Results of Concrete
 - 2) 318, Building Code Requirements for Reinforced Concrete
 - b. ASTM International (ASTM)
 - 1) C31, Practice for Making and Curing Concrete Test Specimens in the Field
 - 2) C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 3) C138, Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - 4) C143, Slump of Hydraulic Cement Concrete
 - 5) C173, Air Content of Freshly Mixed Concrete by the Volumetric Method
 2. Compression Test Cylinders:
 - a. Make, transport, cure and test six (6) inch or (4) inch diameter by 12-inch-long test specimens taken from concrete being cast. Test cylinders will be made, handled, cured, and stored in accordance with ASTM C31, at the rate of four (4) cylinders minimum for each 50 cubic yards slab on grade or elevated slab four (4) cylinders minimum for each 100 cubic yards paving or fraction thereof of each class of concrete placed in any one (1) day.
 - b. Handle newly made cylinders carefully to avoid cracking the green concrete. Store these cylinders in a box at temperatures between 60 degrees F and 80 degrees F during first 24 hours. Contractor shall construct a suitable box and provide heat or cooling, if necessary, to maintain cylinders at proper temperature.

3. Noncompliance: In the event the initial tests above indicate that concrete may not meet the specified requirements, the Architect or Engineer may, at his discretion, order additional tests be performed at the Contractor's expense. Load tests shall comply with requirements of ACI 318.

3.11 MASONRY

A. Inspection and Observation Services:

1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
2. Review mortar design mixes.
3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

B. Testing Services:

1. References (As applicable for tests required):
 - a. ASTM International (ASTM)
 - 1) C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units
 - 2) C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
 - 3) C1019, Standard Test Method for Sampling and Testing Grout
 - 4) E447, Standard Test Methods for Compressive Strength of Laboratory Constructed Masonry Prisms
2. Testing of Concrete Masonry Units (CMU):
 - a. Preconstruction: Perform the following tests in accordance with ASTM C140.
 - 1) Compressive Strength
 - 2) Absorption
 - 3) Weight
 - 4) Moisture Content
 - 5) Dimensions
3. Mortar Tests:
 - a. Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.
 - 1) 28 Day Compressive Strength
 - 2) Water Retention
 - b. Construction: Perform 28-day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
4. Refer to and include work for reinforcing steel specified in Paragraphs 3.5 and 3.6 above.
5. Grout Tests:
 - a. Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
 - 1) Slump Test
 - 2) 28 Day Compressive Strength
 - 3) Construction: Perform 28-day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
 - 4) Prism Test: Perform preconstruction 28-day compressive strength test on concrete masonry walls in accordance with ASTM E447, Method B.

3.12 STRUCTURAL STEEL

A. Inspection Services:

1. General:
 - a. Review submittals from fabricator.
 - b. Review all shop and field welder's qualifications.
2. Structural Steel, Steel Joists and Mechanical Piping:
 - a. Shop inspect each member for defects such as cracks, excessive camber, deformation, and specified surface preparation prior to shop priming or galvanizing.
 - b. Inspect shop priming for coverage and measure of mil thickness.
 - c. Perform visual inspection of all welds; measure 15 percent of welds.
 - d. Inspect size and placement of anchor bolts in concrete and masonry.
 - e. Verify that erector surveys plumbness of each column.

- f. Verify that erector inspects alignment of beams, shelf angles, lintels, joists, joist girders, and other similar supporting members.
 - g. Perform visual inspection of bolts to determine that the method(s) used are in conformance with the Contract Documents.
 - 3. Metal Decks:
 - a. Field inspect material for type, gauge, finish and other requirements of the Contract Documents.
 - b. Field inspect installation methods including welding, alignment, joints, laps, and flatness, and all other requirements of the Contract Documents.
 - 4. Steel Stud Shear Connectors:
 - a. Field inspect installation methods and welds.
 - b. Verify number of studs, stud placement and length for conformance with the Contract Documents.
- B. Testing Services:
 - 1. References (As applicable for tests required):
 - a. American Institute of Steel Construction (AISC)
 - 1) Specifications for Structural Joints Using ASTM A325 or A490 Bolts
 - b. ASTM International (ASTM)
 - 1) A6, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
 - 2) A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 3) A490, Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
 - b. American Welding Society (AWS)
 - 1) D1.1, Structural Welding Code, Steel
 - 2. Structural Steel:
 - a. Perform all tests required by Structural Welding Code and authorities having jurisdiction.
 - b. Ultrasonically test all edges of material greater than 1-1/2 inch thick that is to be welded for evidence of laminations, inclusions, or other discontinuities. The extent to which such defects will be permitted, and the extent of repair permitted shall be in accordance with ASTM A6.
 - c. The root layer of all multiple pass welds and the backside of groove welds made from both sides, after back gouging or chipping, shall be tested by magnetic particle or dye penetration if magnetic particle is not feasible.
 - d. Fillet welds for beam and girder shear connections (15 percent at random) shall be tested by magnetic particle for final pass only.
 - e. Fillet welds for plate girder flange/web connections shall be tested by magnetic particle for final pass only.
 - f. Ultrasonically test 100 percent of full penetration welds.
 - g. Ultrasonically test 100 percent of partial penetration column splice welds.
 - h. Test 100 percent of continuity plate fillet welds by magnetic particle for final pass.
 - i. Perform all equipment calibrations and production tests of high strength bolt connections as required by AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - j. Randomly sample bolts, nuts, and washers from the Project Site at a rate sufficiently to test and verify compliance with ASTM Standards.
 - k. When bolts are tightened by "turn-of-the-nut" method, check by calibrated torque wrench 25 percent of bolts in each shear connection, but not less than two (2) bolts per connection.
 - l. In addition, provide at least one (1) test per 50 linear inches of weld by each welder, except that 100 percent of full penetration welds shall be tested using approved

- radiographic, magnetic particle, or ultrasonic method. Tolerance for welds shall be in accordance with the requirements of AWS D1.1 and the Contract Drawings.
- m. Perform tension tests on steel in accordance with ASTM A6, if required.
 - n. Perform load tests on structural members in place, if required.
3. Steel Stud Testing:
- a. Test not less than ten (10) percent of studs on any beam, plus all studs indicating imperfections. Studs will be considered imperfect if, after welding, visual inspection reveals:
 - 1) Studs lacking full 360-degree weld.
 - 2) Studs which have been repaired by welding.
 - b. Studs shall be tested by striking with a hammer and bending to approximately 15 degrees off vertical. Bend studs lacking full 360 degrees weld in a direction opposite to the side lacking the weld. Replace studs that crack after this test either in the weld or the shank. Studs meeting this test will be considered acceptable and left in place.

3.13 SPRAYED-ON FIREPROOFING

- A. Inspection Services:
 - 1. Inspection of sprayed-on fireproofing to ascertain compliance with Contract Documents.
- B. Testing Services:
 - 1. References (As applicable for tests required):
 - a. ASTM International (ASTM)
 - 1) E605, Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 2) E736, Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 2. Perform tests on sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 3. Perform tests on sprayed-on fireproofing for cohesion and adhesion in accordance with ASTM E736.

3.14 LIGHTWEIGHT INSULATING CONCRETE FILL

- A. Inspection and Observation Services:
 - 1. Inspection of roof deck prior to start of work.
 - 2. Inspection during installation of insulation and lightweight insulating concrete fill work to ascertain compliance with Contract Documents.
 - 3. Observation of base ply fastener pull tests performed by Testing Lab to ascertain minimum withdrawal resistance of 40 pounds per square foot per fastener, based on ANSI/SPRI Protocol. Architect and Roofing Inspector to witness fastener pull tests.
- B. Testing Services:
 - 1. References (As applicable for tests required):
 - a. ASTM International (ASTM)
 - 1) C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded-Hot-Plate Apparatus
 - 2) C495, Test Method for Compressive Strength of Lightweight Insulating Concrete
 - 3) C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - 2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
 - 3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
 - a. Mix design compressive strength.

- b. Mix design wet and dry density range.
- c. Number of Tests:
 - 1) One (1) per 5,000 square feet
 - 2) Not less than one (1) for each day's work
4. Test EPS insulation board for density in accordance with ASTM C578.

3.15 ROOFING SYSTEM

- A. Inspection and Observation Services:
1. Attend pre-construction meeting prior to Contractor starting work.
 2. Attend pre-installation meetings for decking, lightweight concrete, roofing, and sheet metal installations.
 3. Review field mockups of sheet metal and other components as applicable.
 4. Inspect on-site condition of stored roofing materials
 5. Provide full-time roofing inspector during the following stages of construction:
 - Final stages of metal deck attachment
 - Lightweight concrete roof deck application
 - Modified bitumen roofing and metal roofing application
 6. Provide spot inspections for sheet metal work and thru-wall flashing. Thru-wall flashing shall be left open by the Contractor until inspected, and sheet metal shall not be covered until inspected.
 7. Witness water tests and pull tests completed by others.
 8. Observe roof test cuts, and patching of cuts, performed by Contractor to ascertain that they are properly made.
 9. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.
 10. Provide a written daily report in standardized format to Owner within 72 hours of inspection. The report shall describe all roofing-related activities as well as recommendations made to Contractor by the Inspector. The report shall also include a running list of items from previous reports that have not yet been addressed by Contractor. The reports shall also include an itemization of items that should be backcharged to the Contractor. Submit report to Contractor, Architect, and Owner.
 11. Provide and maintain a sign-in sheet in the construction trailer. **Inspector shall sign in and out for every inspection, or Owner will not pay for that inspection.**
 12. Attend the punch list walk and provide a written punch list of all roofing components to Architect and Owner.
 13. Conduct a final inspection of all roofing components and provide Owner with a letter confirming that all punch list items are complete.
 14. Review Siplast Warranty and provide a letter to the Owner confirming that it is correct and complete.

3.16 GLAZED SYSTEMS, TRANSLUCENT WALL PANEL SYSTEMS AND SKYLIGHTS

- A. Testing Services:
1. Perform air and water infiltration testing on initial installation of each exterior glazed system, translucent wall panel system and skylight to ascertain compliance with specifications.

PART 4 – GENERAL – PROJECT CONSULTANT OBSERVATIONS

4.1 DESCRIPTION

- A. The Contractor shall include in his Proposal the coordination and scheduling of Observations to be performed by the Owner and Architect's project consultants, as they may apply to this work.
- B. All project consultant observation services shall be performed by designees of the relative consultant; upon which the Contractor may rely as to the capability and thoroughness of the observation being performed. Upon request by the Contractor, the names of inspectors performing specific observations shall be furnished by the Architect.
- C. The Owner shall pay for the observation services of the project consultants in accordance with the Owner / Architect Agreement and the requirements of the Contract Documents. Excessive observations and re-observations resulting from the Contractor's actions as described in paragraph 4.4 below, shall be paid for by the Contractor directly to the affected Consultant.
- D. The Contractor shall cooperate with the Owner's project consultants in all matters pertaining to required observations of the work as described in the Contract Documents. The Owner retains the option to add to or delete any or all observations specified herein; and thereby accept the relative work without observation.

4.2 RELATED REQUIREMENTS

- A. Conditions of the Contract, AIA Document A201 as amended, and Supplementary Conditions to the General Conditions for the Construction Contract, Specification section CA.
- B. Respective Sections of Specifications describing the required consultant observations.

4.3 AUTHORITIES AND DUTIES OF THE PROJECT CONSULTANT INSPECTORS

- A. The project consultant inspectors are not authorized to revoke, alter, relax, increase, or release the Contractor from any requirement of the Contract Documents without written notice furnished to the Contractor by the Architect. When it appears that the material, assembly or work performed by the Contractor fails to fulfill Contract requirements, the project consultant inspector shall promptly notify the General Contractor, Architect and Owner.
- B. The project consultant inspector(s) shall distribute copies of the observation reports within two (2) working days. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor.

4.4 PROJECT CONSULTANT OBSERVATION GUIDELINES AND PROCEDURES

- A. Project Consultants shall make all observations required in the Contract Documents and requested by the Architect, Contractor and/or Owner.
- B. For each material, assembly or phase observation required in the Contract Documents, and upon request by the Contractor, the project consultant(s) shall perform the following observations as required in the Owner – Architect Agreement:
 - 1. Initial observation to determine compliance with the Contract Documents.
 - 2. Observation to determine deficiencies where the initial observation results do not show 100% compliance with the Contract Documents. At the consultant's discretion, this observation may be performed concurrent with the initial observation.

The above series of observations shall be at the expense of the Owner in accordance with the Owner/Architect Agreement. If re-observation is required to determine 100% compliance is required, it shall be at Contractor's expense.

- C. In the event the observation series described above does not result in 100% approval of the material, assembly or phase being inspected, all subsequent re-observations required to achieve 100% approval

shall be at the sole expense of the Contractor to be paid to the project consultant (via Owner backcharge to the Contractor) based on the consultant's standard hourly rates for time expended, including travel to and from the site.

- D. Recognizing the size and complexity of work included in a project may be sufficiently large enough to require the project to be divided into scope areas, each such area shall be considered separate and stand-alone with respect to paragraph 4.4.B above. Requests by the Contractor for project consultant observations of partial scope areas shall be considered observations of the entire scope area with respect to paragraph 4.4.B above; and subsequent observations of the remaining portions of the same scope area shall be paid for by the Contractor (via Owner backcharge to the Contractor). Owner shall invoice the Contractor on a monthly basis, and payment shall be due upon the Contractor's receipt of the invoice.
- E. The Contractor shall bear the responsibility of requesting and scheduling all project consultant observations required by the Contract Documents. The Contractor shall give the project consultant a minimum of forty-eight (48) hours' notice prior to the requested observation. No extension of Contract Time shall be granted for untimely observations due to the Contractor's failure of proper observation request notification.
- F. Observations voluntarily made by project consultants at their discretion, not specifically requested by the Contractor, shall not count as one of the observations described in paragraph B above, nor shall the Contractor be liable for any related expenses.

4.5 PROJECT CONSULTANT OBSERVATIONS

- A. Earthwork
- B. Site Utilities prior to cover-up
- C. Concrete Reinforcing
- D. Cast-in-place concrete
- E. Structural steel
- F. All Building Envelope assemblies
- G. Mechanical rough-in prior to cover-up
- H. Plumbing rough-in prior to cover-up
- I. Electrical rough-in prior to cover-up
- J. Above ceiling prior to cover-up
- K. Start-up demonstrations of building systems and components
- L. Punch lists (treated separately for each architect and consultant). Refer to Specification Section CA, section 9.8
- M. Observation / review of O&M Manuals and other close-out documents
- N. Observation / review of Record Drawings

4.6 PROJECT CONSULTANT HOURLY RATES

- A. Refer to the A201 General Conditions of the Contract for Construction, as Amended Article 8 for applicable hourly rates.

PART 5 – GENERAL – GOVERNMENTAL INSPECTIONS

5.1 DESCRIPTION

- A. The Contractor shall include in his Proposal the application, coordination, scheduling and cost of all on-site inspections to be performed by governmental authorities having jurisdiction which are required for approval of the Work and occupancy of the building; including, but not limited to all City departments, all County departments, Flood Control Districts, Municipal Utility Districts, utility provider, Health Departments and Fire Marshal Offices.
- B. The Contractor shall make all corrective measures in accordance with instructions received from the governing authority inspector having jurisdiction, as required to receive 100% approval for the work being inspected.
- C. The Contractor shall bear all costs for initial inspections, re-inspections and any other expenses related to on-site inspections made by governing authority.
- D. No allowance shall be made for additional Contract Time, nor an increase in the Contract Sum for any unanticipated expenses or delays resulting from failed governmental inspection or resulting re-inspections required to obtain approval(s).

5.2 EXCLUSION

- A. The Contractor shall not be responsible for making application, coordination, inspections and receiving approval of the Work by the Texas Department of Licensing and Regulation relative to ADA and Texas Accessibility Standards.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.
- B. Temporary facilities shall only be for the duration of construction, unless noted otherwise, and all temporary facilities shall be completely removed at the completion of the project. Any areas disturbed by the placement of temporary facilities shall be repaired/replaced to a finished condition consistent with the surrounding finished area.

1.2 UTILITIES

- A. The Contractor shall supply temporary job power, drainage outfall, sanitary sewer, and water hook-ups for site. The Contractor shall provide all wiring, lamps, distribution of power and similar equipment as required for construction, inspection, and testing of each project.
- B. The Contractor is responsible for overloading or excess use, or any damage resulting from overloading or excess use, or any damage resulting from his use of utilities.
- C. The General Contractor shall provide temporary heat to prevent freezing and maintain proper temperatures to avoid damage to materials in the building and allow work to continue in such weather conditions. The General Contractor shall provide and maintain such dependable source of supply, such as heat, as may be necessary until the building is accepted.
- D. The Contractor will be required to provide temporary water and electrical connections for field sprinkler systems after Substantial Completion of the fields. These connections must be maintained through the duration of the Contract, or until permanent connections are made.
- E. Any utility usage at existing buildings in excess of 110% of historical usage for the previous 12-month period shall be paid by the Contractor.

1.3 FIELD OFFICE

- A. The Contractor will be required to furnish a job trailer installed at a suitable location (on site at one campus), for use by the Contractor, Architect, and Owner.
- B. Provide and maintain a weather-tight building with operable and lockable door and windows, to serve as a job office available to the Contractor, subcontractors, Owner, and the Architect. Provide lights, electricity, air conditioning and heat, as required. Remove office from premises when one can be set up inside the building. Provide job site telephone, internet, and other miscellaneous items as outlined below.
 - 1. Provide a separate lockable room (120 sq. ft.) in Contractor's job trailer to serve as an office for the Architect and Owner's representative or provide in a separate building in close proximity to Contractor's office.
 - 2. Contractor's office shall be of a size, and shall be furnished, so that it may be used for small progress meetings (seating for approximately 8 persons at table).
 - 3. Provide adequate artificial lighting, heating and cooling to provide comfortable conditions for occupants.
 - 4. Provide direct line telephone service for both voice communication and internet connection.
 - 5. Furnishings Required:
 - a. Contractor's Office: Racks and files for Contract Documents and for Record Documents; conference table and chairs; and desks and chairs as required by Contractor.

6. Provide high speed data access with internet access and wireless access point/router.

1.4 SANITARY FACILITIES

- A. Furnish temporary sanitary facilities and maintain in compliance with regulations of State Department of Health and other authorities having jurisdiction (minimum of one water closet and hand sink).

1.5 STORAGE FACILITIES

- A. Provide and maintain adequate weathertight lockable storage facilities, raised above the ground, with sides and top enclosed.
- B. Replace materials improperly stored and damaged by weathered conditions.
- C. Remove storage facilities when materials are stored within the structure in a weathertight condition.
- D. Allow for temporary freeze protection as needed.
- E. Address any storage needs for owner equipment, furniture, etc.

1.6 SIGNS

- A. Within three weeks after receipt of Notice to Proceed, provide one project identification sign and install in a location designated by the Owner at each campus.
- B. Fabricate the sign with sturdy wood framing and 3/4-inch-thick exterior grade plywood, with aluminum overlay and applied digitally printed vinyl sign, a minimum area of 64 cumulative square feet (8' x 8'). No other signs, except as allowed herein, shall be allowed to be displayed on the site. Contractor shall submit a scaled shop drawing of the sign, including all lettering, to the Owner for approval prior to installation.
- C. Project sign shall incorporate design layout as provided by Architect, and shall include:
 1. The official title of the Project as listed on Contract Documents.
 2. The name of the Owner as listed on Contract Documents.
 3. The names and titles of School Board Members and School Administrators.
 4. The names and titles of Architect.
 5. Identification number of the Contractor.
- D. Erect signs on 4" (102 mm) x 4" (102 mm) supports set firmly into the ground and well braced. The bottom of the sign is to be a minimum of 4' above grade, unless otherwise instructed by the Architect.
- E. Other signs required at the site:
 1. Warning, directional, and identification signs as required to indicate construction office location, and to facilitate campus operations that are impacted by construction.
- F. Contractor shall provide necessary signage to accommodate all Owner needs necessitated by the Work including temporary walking/driving routes, deliveries, etc.
- G. Allow no other signs to be displayed at the project site, unless authorized by the Owner.
- H. Secure and pay for all sign permits as required by local authorities.
- I. The sign shall remain the property of the Owner, and upon final completion, the Contractor shall remove the sign and deliver it to a location designated by the Owner or dispose of sign if directed by Owner.

1.7 BARRIERS

- A. Provide temporary barricades on all portions of the site as required to secure the construction area and affected areas of building and site.
- B. Provide approved barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, water puddling and continuous running water.
- C. Provide temporary partitions as needed to separate work areas from building occupants.

1.8 SECURITY

- A. Determine if and when watchmen are necessary for protection to the work and provide such services when necessary. Neither the provision of watchmen nor the failure to provide watchmen shall relieve the Contractor of responsibility in event of injury to persons or damage to property.

1.9 CLEANING

- A. Trash Removal: Clear the building and site daily of trash. When rapid accumulation occurs, make more frequent removals. Remove highly combustible trash such as paper and cardboard daily. Dumpsters will not be allowed to overflow and should be emptied on a regular basis. Subcontractors shall provide their own dumpsters for disposal of their debris.
- B. Daily cleanup (renovation and new construction projects): Daily cleanup is required both within construction area, and also for any areas on site that are used by Owner (sidewalks, drives, roads, corridors, etc.).
- C. Disposition of Debris: Remove debris from the site and make legal disposition. Locations for disposal shall be of the Contractor's choice within the above restriction. Neither debris nor material may be buried or burned at the site. Take necessary precautions to prevent accidental burning of materials by avoiding large accumulations of combustible materials.
- D. Refer to Section 01 71 50 for Preventive Housekeeping.

2.0 TEMPORARY FIRST AID FACILITIES

- A. Provide first aid equipment and supplies, with qualified personnel continuously available to render first aid at the site.
- B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: physicians, ambulance services and hospitals.
- C. Provide and maintain one Automated External Defibrillator (AED) unit throughout duration of the project.

2.1 TEMPORARY FIRE PROTECTION

- A. Provide a fire protection and prevention program for employees and personnel at the site; and provide and maintain fire extinguishing equipment ready for instant use at all areas of the project, and at specific areas of critical fire hazard.
- B. Equipment:
 - 1. Hand extinguishers of the types and sizes recommended by the National Board of Fire Underwriters to control fires from particular hazards.
 - 2. Barrels of water with buckets designated for fire control purposes.
 - 3. Water hoses connected to an adequate water pressure and supply system.
 - 4. Construction period use of permanent fire protection system.

- C. Enforce Fire-safety Discipline:
 - 1. Store volatile materials in an isolated, protected location.
 - 2. Avoid accumulations of flammable debris and waste in or about the Project.
 - 3. Prohibit smoking on CFISD property and in the vicinity of hazardous conditions.
 - 4. Closely supervise welding and torch-cutting operations in the vicinity of combustible materials and volatile conditions, including roofing torching operations.
 - 5. Supervise locations and operations of portable heating units and fuel.
- D. Maintain fire extinguishing equipment in working condition, with current inspection certificate attached to each extinguisher.
- E. Contractor shall coordinate and comply with all requirements of Owner's personnel, as well as those of governing authorities.

2.2 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required to assure safety for personnel and to facilitate the execution of the work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other equipment.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Maintain all equipment in a first-class, safe condition.

2.3 ACCESS ROADS AND PARKING AREAS

- A. Submit to CFISD for review and upon written approval, provide adequate temporary roads and walks to achieve all-weather car access into the site from public thoroughfares, and within and adjacent to the site, as necessary to provide interrupted access to field offices, work and storage areas. All temporary access roads and walks shall be removed upon completion of permanent facilities, or completion of construction.
- B. Provide adequate parking space for personnel and employees at the site, located to avoid interference with traffic adjacent school facilities and functions, work or storage areas, or with materials-handling equipment.
- C. Grade and provide drainage facilities to assure runoff of rainwater and to avoid blockage of flow from adjacent areas.

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Measures to ensure adequate quality control and quality assurance for all Work in accordance with Conditions of the Contract, as specified herein, and with the quality control and quality assurance requirements of each Specification Section, and authorities having jurisdiction.

1.2 RELATED SECTIONS

- A. All Sections of Work requiring layout, survey, reference points and their verification and protection, and quality control and assurance monitoring requirements.

1.3 DEFINITIONS

- A. Survey and Field Engineering: Wherever the terms “Survey”, “Field Engineering” or any derivative thereof, or similar term appears within this Section, they mean one and the same, and shall mean the survey or field engineering work performed by the Field Engineer as defined below and is separate from that of the survey work provided by the Owner.
- B. Field Engineer: Wherever the term “Field Engineer” or any derivative thereof, or similar term appears in the Contract Documents, it shall refer to the General Contractor’s employee(s) that are expert in, routinely engaged in, and have at least five (5) years experience in, the practice of construction project field engineering, building and project layout, construction measurements and monitoring, etc.
- C. “Construction Surveyor”: Wherever the term “Construction Surveyor”, or any derivative thereof, or similar term appears in the Contract Documents, the entity (person or firm) licensed as a Registered Professional Land Surveyor or Professional Engineer of the discipline required for specific service on the Project in the State in which the Project occurs, with five (5) years minimum experience, and meeting all applicable regulations of the State in which the Project occurs and Department of Labor, and other authorities having jurisdiction to perform the Work. To avoid any misunderstanding or lack of interpretation, the entity responsible for performing the Work of this Section shall be employed by the General Contractor, and the responsibility, including methods and means, is totally that of the General Contractor.
- D. Quality Control and Quality Assurance: Wherever the terms “Quality Control”, “Quality Assurance” or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean an aggregate of activities of the General Contractor, such as design analysis and statistical sampling with inspection for defects, designed to ensure adequate quality in materials and workmanship whether factory manufactured or jobsite produced.

1.4 QUALITY CONTROL AND QUALITY ASSURANCE

- A. Employ a Construction Surveyor complying with the definition above and acceptable to the Owner and Architect, to perform all Construction Surveying. Provide full responsibility for the Construction Surveyor and accuracy of the performance of all items of Work shown on Drawings, specified herein, or in other Specification Sections.

SUBMITTALS FOR REVIEW

- A. Submit name, address, telephone number, fax number, and registration number of the proposed Construction Surveyor prior to starting Work of this Section.
- B. Submit evidence of Construction Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate, if different from Construction Manager's.
- C. Upon request by Architect, submit documentation verifying accuracy of all Survey Work, including a certificate sealed and signed by the Construction Surveyor, that the elevations and locations of the Work are in conformance with Contract Documents and such information has been incorporated into the Project Record Documents.
- D. Submit Project Record Documents under provisions of Section 01 77 00, Closeout Procedures.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of discrepancies discovered.

3.2 SURVEY REFERENCE POINTS

- A. Locate and protect survey control and reference points.
- B. Control datum for survey is that established by the Owner provided survey and as indicated on Drawings.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original Owner's survey control. Make no changes without prior written permission of Architect.

3.3 FIELD ENGINEERING AND CONSTRUCTION SURVEYOR REQUIREMENTS

- A. Establish a minimum of two (2) permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. Field Engineer shall establish elevations, lines and levels. Locate, lay out, and monitor by instrumentation and similar appropriate means Work, including, but not be limited to:
 - 1. elevations, and layout of property lines and easements;
 - 2. site drainage, including storm water control and pollution prevention measures, slopes, swales, and invert elevations;

3. limits of clearing and grubbing, including identification of trees and planting to be removed and methods for protection of those to remain;
 4. excavations, fill and topsoil placement, and all (rough and finish) grades;
 5. trenching and trench safety;
 6. utility locations;
 7. concrete and asphaltic concrete paving, curbs, ramps, and other site improvements, as applicable;
 8. grid or axis for structures, batter board locations;
 9. elevation, grade controls, and layout of building foundation and grade beams, column locations, base plates, embedded items, depressions, formwork, and openings in concrete, including all interior finish grades;
 10. elevations of structural steel, including, steel joists/trusses, steel decks, and associated miscellaneous metals;
 11. elevations and layout of masonry, including concrete masonry units (CMU), face brick, cast stone, and other elements built-in masonry.
 12. elevations and slopes of roofing, including those for lightweight insulating concrete deck system, if applicable.
 13. elevations and layout of work as required to ensure proper operation, clearances, and tolerances, including conveying systems, plumbing and mechanical work; and
 14. monitoring of movement and protection of existing or adjacent structures, as applicable.
- C. Throughout course of Work, verify existing conditions and layouts by same means as originally used to ensure conformance with design requirements and details. Notify Architect immediately, if discrepancies are found.
- D. Provide one (1) copy each of reduced Field Engineer's notes to the Architect, Owner, Construction Surveyor, and affected Consultant within four (4) working days of completion of each portion of the Field Engineering Work.
- E. Field Engineer's notes shall be clear and complete. The Field Engineer shall be available at no expense to the Owner, Architect, or Consultants for note interpretation, if required.
- F. Field Engineer shall perform surveys to determine quantities of unit cost work, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- G. Provide Construction Surveying services. Utilize recognized engineering survey practices.
- H. Construction Surveyor shall verify and record/document their findings, on a drawn survey at a scale matching that of the original Contract Documents, for the following:
1. All property lines and corners
 2. All building corners
 3. All paving corners
 4. Finish floor of all/each buildings
 5. Invert elevations, flow lines for all site drainage structures and improvements
- I. Payment for earthwork quantities shall be for materials in place, compacted, and determined by neat line method.
- J. Provide the Owner a reproducible hard copy and digital/electronic file copy of all the Construction Surveyor's work.

3.4 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and Field Engineer work as it progresses.
- B. Upon completion of Work, including, but not limited to earthwork, formwork, foundation, structural steel erection, and major site improvements, prepare Project Record Documents illustrating dimensions, locations, angles, and elevations of construction and site work.
- C. Submit Project Record Documents as specified in Paragraph 1.5.

END OF SECTION

SECTION 01 71 50

PREVENTIVE HOUSEKEEPING AND FINAL CARPET CLEANING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Cleaning of new and existing Tandus Powerbond carpet within the Project work area at the end of each work window upon substantial completion of work scheduled each day. Work window shall be determined by and coordinated with Owner.
- B. Clean entire area of building where construction or scope of work occurs, and all areas affected by construction activities including but not limited to dirt, debris and construction dust.
- C. Preventive Daily Housekeeping. The following are intended as a guide to facilitate the daily maintenance and cleanliness of the construction site, including but not limited to:
 - 1. Renovations involving the commons cafeteria where the stage curtain may be exposed/soiled by construction materials, dirt, dust etc. the curtain shall be removed prior to construction and stored according to curtain Manufacturer's recommended procedures and methods. Contractor reinstall after final cleaning. Contractor is responsible for curtain cleaning should it become soiled from construction activities per Curtain Manufacturer's methods.
 - 2. Contractor to segregate phased and/or areas of construction from all other areas of the building with a sealed, airtight construction barrier.
 - 3. Contractor shall provide additional AHU air filtration to protect existing Owner HVAC systems and other areas of building from becoming soiled from construction activities and dust. Should construction dirt and dust accumulate in affected construction areas, Contractor shall provide final cleaning of those spaces.
 - 4. Contractor is to prevent daily accumulation of construction dust or any other material that can cause any safety hazard.
 - 5. Contractor to eliminate, as practical as possible, tracking of dirt and debris prior to entering building each time.
 - 6. In an effort to protect existing flooring surfaces, Contractor is responsible for providing adhesive plastic sheeting and Masonite and/or plywood to prevent accumulation of all contaminants, including but not limited to: dirt, damaging foot traffic, lift equipment, machinery oil, etc. Continuously inspect and provide replacement/maintenance as needed of sheeting and Masonite/plywood as appropriate to construction intensity.
 - 7. Daily cleaning and maintenance of existing carpet to utilize procedure itemized in subsection 3.1 prior to cold water extraction.

PART 2 – PRODUCTS

2.1 CERTIFIED MAINTENANCE PARTNERS

- A. Corporate Care
Phone: 713-692-6300
Attn: Sean Barnett
- B. GCA Services Group
Phone: 972-276-5858
Attn: Dub Spencer

- C. Texan Floor Service
Phone: 713-956-9966
Attn: Jeff Hill

2.2 MATERIALS

- A. Cleaning Solutions: Cleaning solutions shall be used according to manufacturer's instructions. Review the material safety data sheets (MSDS) and/or safety data sheet (SDS), and product labels on solutions, being aware of any precautions and usage guidelines.
1. Below are the minimum requirements for cleaning solutions to be used on C&A carpet. Contact your supplier to assure that these guidelines are met:
 - a. Shall be safe and non-toxic.
 - b. Shall contain no optical brighteners.
 - c. Shall have a pH between 5 and 9 diluted for normal cleaning.
 - d. Do not leave a sticky or oily residue when dried.
 - e. Will not damage carpet's fiber or color.
 - f. Will not promote rapid soiling.
 2. Conduct the following test to evaluate the type of residue a solution leaves behind:
 - a. Prepare the solution and pour in a pan.
 - b. Place in direct sunlight and allow to evaporate. If it leaves a sticky or oily residue, do not use. The carpet manufacturer can provide approved cleaning agents and deodorizers for the specific carpet. These cleaners have been tested for appropriate pH levels, absence of optical brighteners and zero resoil potential.

2.3 EQUIPMENT

- A. Equipment: Use the effective, well-functioning equipment:
1. Vacuum Cleaner: Use a commercial vacuum cleaner that exceeds the established industry standards for soil removal. For improved indoor air quality, the vacuum shall have high efficiency filtration and shall emit minimal particles into the air. (The carpet manufacturer can provide a list of suggested vacuum cleaners.)
 2. Pile Lifter: Use a pile lifter to assist in the cleaning process to aggressively lift the pile fiber and loosen attached soil prior to vacuuming. Because of this aggressiveness, caution must be used when cleaning C&A's Symtex® products. (The carpet manufacturer can provide a list of suggested pile lifters.)
 3. Extractors: Provide hot water extraction for final deep cleaning and maintenance.
 - a. Selection should be based upon the needs of the facility. In general, the following minimum performance should be considered:
 - 1) Extractor should be C&A approved and capable of extracting a maximum volume of water injected into carpet pile fiber.
 - 2) Components should be made of a material that is non-corrosive and will not rust or deteriorate in the presence of water and/or cleaning solutions.
 - 3) Extractor should be able to generate a minimum of 50 pounds per square inch (psi) of pressure and should not exceed 400 psi.
 - 4) The carpet manufacturer can provide a list of suggested extractors.
 4. Portable Air Mover:
 - a. Carpet can dry within 2 to 3 hours in most environments. Drying time should never exceed 12 hours.
 - b. When extreme environmental conditions exist (relative humidity exceeds 65%), an air mover or drying fan should be used to accelerate drying time.
 - c. The carpet manufacturer can provide a list of suggested portable air movers

PART 3 – EXECUTION

3.1 PROCEDURE

A. Cleaning Procedures:

1. Vacuuming

- a. Make sure the vacuum cleaner is in proper working order before each use. (Clean all components regularly.)
- b. Use slow, overlapping passes. Slowing the vacuum down allows the suction to loosen and remove the embedded dry soil that can abrade and damage fibers.
- c. Pay careful attention to the “pull” stroke. More soil is removed in this action than in the forward stroke.
- d. Empty vacuum bags when they become half full to improve soil removal.
- e. Replace nylon brushes at the first sign of wear.
- f. Use only original equipment manufacturer parts for consistent performance.

2. Spill Removal

- a. Spills may require cleaning solutions to remove.
- b. The spill/liquid should be blotted into paper or cloth towels.
- c. Place several layers of towels over the spill and apply pressure until all of the excess liquid has been removed.
- d. Use a portable spot removal extractor with cold water solution.

3. Spot Removal

- a. Determine if the spot is a water-soluble or oil-based stain by applying clean water and blot with absorbent towel. Water-soluble spots will transfer to the towel; oil-based spots will not. Clean spot using one of the following methods:
 - 1) For water-based spots: Continue rinsing with water as long as there is transfer to the towel. A cleaning agent may not be necessary if water continues to remove the spot. If a cleaning agent is needed, apply a Manufacturer approved (Collins and Aikman for TanduS carpets) spot lifter to the area and allow to soak for 5 minutes. Then, flush thoroughly with water until all detergent residue has been removed. Repeat this process until the spot is removed.
 - 2) For oil-based spots: After blotting to remove excess liquid, apply a non-water based dry-cleaning solvent* to a towel and apply to the spot. (Applying a dry-cleaning solvent directly to the Carpet surface may allow the spot to spread.) Work from the outer edges of the spot to limit spreading. Continue to reapply solution in this manner until the spot is completely removed. Then flush thoroughly with water until all residue has been removed. In case of permanent stains, repairs may be necessary.*Dry-cleaning solvents denote isopropyl alcohol, denatured alcohol and other, non-water-based cleaning solutions.

4. Extraction

- a. In addition to vacuuming and spot removal, extraction will help maintain Carpet’s appearance.
- b. The procedure for effective soil removal is as follows:
 - 1) Pile lift all heavy soiling areas.
 - 2) Thoroughly vacuum the entire area to remove dry soil.
 - 3) Never use detergent in the extractor rinse tank.
 - 4) Pre-spray the area with an approved pre-spray solution.
 - 5) Use agitation for improved cleaning results.
 - 6) Allow the solution to remain undisturbed for 5 to 10 minutes. This will make the soil easier to remove.
 - 7) Extract the area thoroughly to rinse and remove all the detergent and soil.
 - 8) Repeat until recovery water is relatively clean.
 - 9) Place air movers on the area to expedite the drying time.
 - 10) Limit foot traffic on the area until dry.
- c. Extraction equipment guidelines:

- 1) Make sure extractor is in proper working order.
 - 2) Disinfect freshwater tank and recovery tank on a weekly basis.
 - 3) Replace nylon brushes at the first sign of wear.
 - 4) Use only original equipment manufacturer parts for consistent performance.
5. Tape Residue Removal
- 1) Following removal of carpet and flooring protective measures, including but not limited to plastic sheeting, adhesive plastic sheeting, Masonite, tape, etc., Contractor is responsible for complete removal of tape residue (per flooring manufacturer recommendations) from flooring surfaces prior to final cleaning.

3.2 SCHEDULE

- A. Traffic Patterns: Identify and evaluate the traffic patterns in the facility and get approval from Owner. Using a floor plan of the facility, color code the plan to identify each of the areas.
- B. Cleaning Schedule:
1. Track-Off Areas: Areas where outside soil is tracked in (entrances, lobbies, restrooms, elevators, and areas next to hard-surface flooring). These areas require specific attention.
 - a. Pre-vacuum prior to spot cleaning
 - b. Spot clean to remove entrenched stains
 - c. Vacuum again using multiple passes
 - d. Pile lift to loosen embedded soil prior to extraction
 - e. Wet extract in each direction using multiple passes to achieve desired appearance level
 - f. Spot clean as necessary
 - g. Vacuum
 2. Heavy Traffic Zones: Areas that experience more than 1,000 foot traffics per day (staging areas, traffic lanes, pivot points and funnel areas)
 - a. Vacuum using multiple passes
 - b. Pile lift to loosen embedded soil prior to extraction
 - c. Wet extract to achieve desired appearance level
 - d. Spot clean as necessary
 - e. Vacuum
 3. Moderate Traffic Zones: Areas that experience 500 to 1,000 foot traffics per day (secondary hallways, administrative areas, offices, and light-use common areas)
 - a. Vacuum using multiple passes
 - b. Pile lift to loosen embedded soil prior to extraction
 - c. Wet extract to achieve desired appearance level
 - d. Spot clean as necessary
 - e. Vacuum
 4. Light Traffic Zones: Areas that experience less than 500-foot traffics per day (conference rooms, areas outside of traffic lanes, and limited use-area)
 - a. Vacuum using multiple passes
 - b. Wet extract as necessary to achieve desired appearance level
 - c. Spot clean as necessary
 - d. Vacuum

5. Areas Prone to Spots and Stains: (break rooms, coffee areas and areas near kitchens)
 - a. Pre-vacuum prior to spot cleaning
 - b. Spot clean to remove undesirable stains
 - c. Pile lift and wet extract as required according to traffic zone identification above
 - d. Spot clean again as necessary
 - e. Vacuum

END OF SECTION

GUARANTEES, CERTIFICATES AND CLOSE-OUT

PART 1 - GENERAL

A. Certain procedures have been developed and are required to fulfill all provisions of the Owner-Contractor Agreement with respect to contract Final Completion and Contract Close-Out for the work/project to be 100% complete.

B. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended and Section CB – Supplementary Conditions of the Contract for Construction; as amended for additional information and requirements.

2.1 GENERAL

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- D. Final Cleaning:
1. The work area shall be thoroughly cleaned inside and outside. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces. Refer to Section 01 71 50 for final clean requirements of remodel areas and carpet.
 2. Remove all temporary facilities.
- E. In order for the project, a major portion thereof, a project phase or project campus 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 them 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, interior and exterior, shall have been completed and cleaned except minor items (Punch List) which, if completed after occupancy, will not, in the Owner's opinion, cause any interference to the Owner's use of the building or any portion thereof.
 3. All items stipulated in 2.1-C above.
- F. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner, at his sole discretion, may make (partial) payment of retainage applying to such work or designated portion thereof which is 100% complete and accepted by the Owner. Such payment, if made at all, shall be adjusted in the Owner's favor for work that is incomplete or not in accordance with the requirements of the Contract Documents.
- G. The date of Substantial Completion shall represent day one (1) of the thirty (30) day period to complete all work and correct all deficiencies contained in the Punch List and the ninety (90) day period allowed for complete Contract Close-Out as described below.

2.2 PUNCH LIST

- A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.

- B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:
 - 1. Room number or other suitable location identifier
 - 2. Description of the work
 - 3. Sub-contractor/trade sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
 - 4. Sub-contractor/trade sign-off date
 - 5. General contractor sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
 - 6. General contractor/trade sign-off date
 - 7. A/E consultant sign-off
 - 8. A/E consultant sign-off date
 - 9. If requested by the Owner, provide two additional similar columns for their sign-off
 - 10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire project; and it shall be the responsibility of the contractor/sub-contractor to thoroughly examine the entire project and make corrective measures at all applicable locations.
- C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re- inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.
- D. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items. It is anticipated that the detailed list of items of work to be completed or corrected at the Date of Substantial Completion.
- E. The Contractor's superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect and Consultants shall perform a spot review to determine the adequacy and completeness of the Contractor's punch list.
- F. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants, and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
 - 1. The Superintendent shall record or otherwise take note of all supplementary items.
 - 2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

2.3 OPERATIONS AND MAINTENANCE MANUALS

- A. Operation and Maintenance (O&M) Manuals shall be delivered prior to, and are a condition of, Substantial Completion to allow the Owner the benefit of having the manuals for on-site training and start-up procedures provided by the Contractor.
- B. Operation and Maintenance (O&M) Manuals shall provide concise descriptions, technical information, principles of operation; operating instructions, maintenance instructions and

schedules, MSDS sheets, and other information that will enable the proper on-going operation and maintenance of the material and/or assembly.

- C. Separate O&M Manuals shall be provided for the following as applicable to the project scope of work:
 - 1. Architectural materials, equipment and/or assemblies
 - 2. Food services materials, equipment and/or assemblies
 - 3. Mechanical materials, equipment and/or assemblies
 - 4. Plumbing materials, equipment and/or assemblies
 - 5. Electrical materials, equipment and/or assemblies
 - 6. Low-voltage systems materials, equipment and/or assemblies
 - 7. Theater lighting/sound systems materials, equipment and/or assemblies
- D. Provide O&M Manuals/information for all materials, equipment and/or assemblies where required in individual sections of specifications.
- E. Each O&M Manual shall contain a cover and spine label depicting contents as delineated in paragraph C above; and within each Manual shall be organized in numerical order corresponding to specification sections.
- F. O&M Manuals shall be provided in 3-ring binders similar to close-out manuals described above.
 - 1. O&M manuals shall contain a table of contents listing the specification number with corresponding general description of the material, equipment, and/or assembly included in the manual.
 - 2. The indexed sections shall be divided and identified by tabbing each section as listed in the index.
- G. Deliverables:
 - 1. Provide electronic copy of all O&M manuals for review. Deliver A/E Consultant O&M Manuals directly to the relative A/E Consultant with a copy of the transmittal to the Architect.
 - 2. Resubmit as necessary to obtain final acceptance of Manuals.
 - 3. Once all corrections have been made and the O&M Manuals found to be acceptable, provide one (1) hard copy of each binder and one (1) PDF format electronic copy of each binder to the Architect for transfer to the Owner.

2.4 SUBSTANTIAL COMPLETION SCHEDULE

- A. After the date of Substantial Completion of the project as evidenced by the Certificate of Substantial Completion, AIA document G704-2000, the Contractor will be allowed a period of thirty (30) days, unless extended by mutual agreement or provision of the Contract, within which to complete all work and correct all deficiencies contained in the Punch List attached to the Certificate of Substantial Completion. It is incumbent upon the Contractor to request Substantial Completion **only** when there is assurance that all work included on the Punch List shall be completed within the thirty (30) day time frame.
 - 1. In the event the Owner must take occupancy of the project prior to Contractor's completion of the punch list, the Contractor shall make all adjustments necessary to schedule the work to allow full and normal operation of the project by the Owner.
 - 2. Where this requires work outside of normal business hours, the work shall be provided at no additional cost to the Owner.
- B. Upon Contractor's and sub-contractor's verification that all punch list items have been 100% completed, the Contractor shall notify the Architect and the Architect and consultant(s) shall conduct an on-site observation to verify that all items are 100% complete.

1. On-site verifications for partial completions, if any, shall be conducted by the Architect at the Architect's discretion.
2. If any items shown to be complete by the Contractor are found not to be complete by the Architect, the observation shall be stopped, with such notification to the Contractor.
3. Contractor's requested punch list observations by the Architect shall be limited to a maximum of two (2) per punch list.

1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
2. The weekly meetings shall include a minimum of two (2) hours charge per participant.

1.	Assistant Superintendent:	\$200.00 per hour
2.	Director:	\$175.00 per hour
3.	Project Manager:	\$150.00 per hour
4.	Project Coordinator:	\$120.00 per hour
5.	Administration/Secretarial:	\$50.00 per hour

1.	A/E Principal:	\$175.00 per hour
2.	A/E Project Manager:	\$150.00 per hour
3.	Staff Architect/Consultant:	\$120.00 per hour
4.	A/E Field Representative	\$100.00 per hour
5.	Administration/Secretarial:	\$50.00 per hour

3.1 Not used.

4.1 GENERAL

- A. Upon issuance of the (final) Certificate of Substantial Completion, and per the Owner- Contractor Agreement, the Contractor will be allowed a period of ninety (90) days within which to complete all Contract Close-Out requirements, unless extended by mutual agreement or provision of the Contract.
- B. In addition to all work and requirements described for Substantial Completion, in order to achieve Contract Close-Out, the Contractor shall submit all Close-Out documents per Form AO.

Record Document

- C. Final/ 100% release of retainage will not be authorized by the Architect until the Contractor completes all of the requirements for Contract Close-out; and until all expenses incurred and to be paid by the Contractor have been paid in full.
- D. It is the Contractor's sole responsibility prior to submission to verify that Close-Out documents being submitted for review and acceptance are 100% complete and accurate. The Owner/Architect reserves the right to reject any incomplete close-out documents.
 - 1. Upon discovery by the Architect that Close-Out documents are incomplete and/or inaccurate, the Architect's review shall cease, and the Contractor shall be so notified.
 - 2. The A/E Consultants' will provide a comprehensive list of possible missing and/or incorrect items needed.
- E. It is desirable and beneficial to submit all Close-Out documents as a single submission; however, Close-Out documents may be submitted separately in four (4) deliverables as follows:
 - 1. Close-Out Documents Manual
 - 2. Operations and Maintenance Manuals (required prior to Substantial Completion)
 - 3. Record Drawings
 - 4. Owner's Record Copy of Submittals (one (1) flash drive in PDF format)
- F. Close Out Tracking
 - 1. Contractor shall track the progress of project closeout utilizing excel spreadsheets which will be provided by the Architect (see examples attached at the end of this Spec Section).
 - 2. Contractor shall update closeout tracking spreadsheets weekly and submit electronic copy to Architect twenty-four hours prior to the weekly closeout review meetings.
 - 3. Master Closeout Checklist represents all items required to be provided by the Contractor to the Owner at the conclusion of the project. It is more general in nature and only includes a status of the closeout item in question. It does not drill down into the details of when the item was submitted, why it was rejected, when it was approved, etc. This checklist will be used throughout the project to track all closeout deliverables.
 - 4. Detailed Checklists are more comprehensive lists developed for each section of the closeout requirements. These lists are used by the Contractor to identify and track every deliverable required from each subcontractor. This list will contain a separate entry for each item that is required from each and every subcontractor. It should include the specification section that lists the requirement, a description of the item, responsible subcontractor, and the dates that the items were requested, received, and transmitted to the Owner. The information included in these detailed checklists is used to update the Master Closeout Checklist.
 - 5. A sample of the Master and Detailed Checklists are attached at the end of this Spec Section. An excel file with the checklists will be provided by Architect.

4.2 CLOSE-OUT MANUALS FORMAT

- A. All close-out documents shall be submitted in CFISD provided digital format with detailed table of contents, intext tabs corresponding to the table of contents.
 - 1. The close-out documents must be neatly organized and easily useable, as determined by the Architect and Owner.
 - 2. At completion and final review, submit one (1) electronic PDF file and one (1) flash drive containing close-outs.

Table of Contents

Part 1: Close-Out Log

- a. Project Checklist – Form AO
- b. Close Out Log

Part 2: Project Directory

- a. Project Team (architect, engineer, contractor, consultants)
- b. List of Final Subcontractors/Suppliers/Local Representatives (by Specification Section)

Part 3: Close-out Documents and Affidavits

- a. AIA G707 - Consent of Surety to Final Payment
- b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims
- c. AIA G706A - Contractor's Affidavit of Release of Liens
- d. Subcontractor's Release of Lien

Part 4: Project Documents and Certificates

- a. AIA G704 - Certificate of Substantial Completion
- b. Punch List / Architects Letter Confirming Completed Punch List
- c. Copy of All Permits
- d. Copy of Final Utility Bill or Letter of Transfer
- e. Certificate of Occupancy
- f. Certification of Project Compliance
- g. Hazardous Material Certificate
- h. Asbestos Manifest / TDLR Inspection / EAB Letter / Structural Letter / Material Testing Letter(s) / Commissioning / other Consultants
- i. Form AQ - Certificate of Final Completion

Part 5: Warranties (Compiled Sequentially by Specification)

- a. General Contractor's Warranty
- b. Subcontractor's Warranty
- c. Extended Warranties & Maintenance / Service Agreements

Part 6: Insurance (General Contractor / Subcontractor)

- a. Continued Coverage
- b. Worker's Compensation Certificate

Part 7: Receipts

- a. Extra Stock by Division
- b. Keys
- c. Paint Mix Cards

Part 8: Record Documents

- a. Demonstration and Training Sign-in Sheets by Division with Digital Video
- b. Operations & Maintenance Manuals and Record Drawing Transmittal(s)

4.3 WARRANTIES

- A. All guarantees and warranties required by the Contract Documents shall establish the date of Substantial Completion as day one (1) of the required warranty period; regardless of how long the product, assembly or work has been installed or in operation prior to Substantial Completion.
1. Coordinate with subcontractors and material suppliers to account for provision in their original proposal/bid amount, if necessary.
- B. Contractor's One-Year Warranty: The Contract requires the General Contractor to warrant ALL materials and work provided/furnished for a period of one (1) year following the date of Substantial Completion.
1. The one-year general warranty shall include all labor, material and delivery costs required to correct defective material or installation during the Warranty period.
- C. Sub-Contractor's One-Year Warranty: each sub-contractor that performed work on the project shall be required to submit a one-year warranty similar to the above Contractor's One-Year Warranty for their specific work provided.
- D. Extended Warranties: In addition to the General Contractors and subcontractors' one-year warranty, other required guarantees shall be included in the Close-Out Binder in original issue form. All extended warranties shall begin on the Substantial Completion date; and shall include all labor, material and delivery costs required to correct defective material or installation for the entire required extended warranty period, as specified in the respective specification section.

4.4 RECORD DRAWINGS:

- A. Upon Substantial Completion, the Contractor shall be furnished, at no charge, a complete set of electronic files in AutoCAD release 2018 or later, and Revit if applicable, of all drawings included in the Contract Documents. The title blocks shall be stripped of all logos, disclaimers and licensed seals of the Architect and Consultants.
1. Throughout the construction phase, Architect's and Consultant's supplemental drawings/sketches provided to the Contractor in AutoCAD and Revit format shall be provided to the Contractor electronically and shall be incorporated in the electronic files by the Contractor.
- B. Upon request, the Architect and/or Consultants shall assist the Contractor with understanding the structure and composition of the electronic files to facilitate the generation of the Record Drawings.
- C. The Contractor shall modify the title block on each/every sheet to include only the project name, project address, Owner name, consultants' name and address, date, and clearly identify the set as "Record Drawings".
- D. All record drawings shall be provided in AutoCAD, Revit, and PDF formats. AutoCAD files shall be provided in "E-Transmit" format with all associated external references, image files, plot styles, and blocks included. CAD files shall be provided and labeled by sheet number. External references shall be setup up with relative file paths and not full (absolute) file paths. PDF files that are provided shall be one complete pdf file with the complete set of drawing files. The PDF shall be bookmarked by sheet number. Specifications shall be submitted in the same manner where they are complete pdf files by volume and bookmarked by specification section. In addition to the complete drawing set PDF, a separate file folder shall be provided with each sheet in the set saved as a separate file with the file named by sheet number. Create sub folders by discipline for all the individual sheet files.
- E. All modifications, additions, deletions, and revisions made to the project during the construction phase shall be reflected on the Record Drawings; and shall include, but not necessarily limited to:
1. All as-built dimensions (different than original dimensions)
2. All as-built locations and conditions relative to underground plumbing, sanitary

- and storm piping installations, natural gas piping and electrical conduits; shown accurately to within twelve (12) inches. Notes shall indicate approximate depth of all underground piping and utilities.

4.5 RECORD SUBMITTALS

- A. The Contractor shall maintain and submit a separate set of final submittals to be delivered to the Owner as a condition of Contract Close-Out.
- B. Include only the final version of each submittal, including all submittal review comment sheets from the Architect and Consultant. Versions of submittals that were rejected or required to be revised and resubmitted are not required.
- C. Deliverables:
 1. Deliver one (1) hard copy set of Record Submittals in file boxes, organized in order by specification division, with tabs included for each section of specifications and submittal log of contents of each file box.
 2. Deliver three (3) copies of all Record Submittals in PDF electronic format on three (3) thumb drives or solid-state media drives.

4.6 RECORD SPECIFICATIONS/PROJECT MANUAL

- A. The Contractor shall submit a record copy of specifications in PDF format on thumb drive or solid-state media drive. The PDF shall be formatted as stated in section 4.4, subsection D of this specification document. Record specifications shall be edited to contain only actual manufacturers, products, colors and model numbers actually used in the project.

4.7 CONTRACT CLOSE-OUT SCHEDULE

- A. If the Contractor fails to complete requirements of Contract Close-Out within sixty (60) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the Close-Out documents are completed and accepted by the Owner. During this time the Contractor will be charged for the Owner's, Architect's and any A/E Consultant's time associated with achieving Final Completion.
1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
 2. The weekly meetings shall include a minimum of two (2) hours charge per participant.
 3. Refer to A201 – for Owner and Architect/A&E/Consultants billable times.
- B. In scheduling submission(s) and final approvals of Close-Out documents, the Contractor shall allow for the following review period for each submission:
1. Architect: Ten (10) calendar days
 2. Architect's Consultant: Twelve (12) calendar days.
- C. Additionally, failure by the Contractor to complete Contract Close-Out within the stipulated time will be reported to the Contractor's surety. In the report of deficiency, the Contractor and surety will be informed that, should correction work remain incomplete for fifteen (15) additional days, the Owner at his discretion may initiate action to complete corrective work out of the remaining contract funds in accordance with the Owner-Contractor Agreement, General and Supplementary Conditions to the Agreement as they apply.
1. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete Contract Close-Out within sixty (60) days after the date of Substantial Completion, unless extended by mutual agreement or provision of the contract, will be deducted from the funds remaining to be paid to the Contractor.

4.8 WARRANTY INSPECTION

Refer to: This summary is in accordance with AIA Document A201 § 3.5 - Warranty.

- A. Warranty periods start from Substantial Completion. If repairs are done post-Substantial Completion, warranty periods extend accordingly. The Contractor must track all warranty work and ensure its completion.
- B. Scheduled Inspections:
1. Approximately six months after Substantial Completion, and one month before the expiration of the one-year warranty, the Contractor shall notify the Architect and Owner to schedule a warranty inspection. A minimum of 10 days' notice must be provided to both the Architect and Owner prior to the inspection.
 2. At the scheduled inspections (6 and 11 months after Substantial Completion), the Contractor will inspect the project with the Owner and Architect and correct any deficiencies.
- C. Corrective Action:
1. For any defective work identified, the Contractor must immediately provide the necessary materials and labor to remedy the issues and continue working until the corrections are completed to the satisfaction of the Architect and Owner, even if the corrective work extends beyond the expiration of the warranty period.

- END OF SECTION**

GENERAL COMMISSIONING REQUIREMENTS

1.1 RELATED DOCUMENTS

- ## 1.2 SUMMARY

- A. This Section establishes general and administrative requirements pertaining to commissioning of equipment, devices, and building systems on the project. Technical requirements for commissioning of particular systems and components are established in the respective technical sections of this Project Manual.
- B. It is of primary concern that all operable systems installed in the Project perform in accordance with the Contract Documents, the Owner's Project Requirements (OPR) and the Basis of Design (BOD). During Commissioning, the Contractor systematically demonstrates to the Owner or Owner's representative that the operable systems have been installed and performing in strict accordance with the Contract Documents.
- C. Commissioning requires cooperation and involvement of all parties throughout the construction process. The Contractor shall deliver a successful Commissioning process. Successful Commissioning requires that installation of all building systems complies with Contract Document requirements and that full operational check-out and necessary adjustments are performed prior to Substantial Completion with the exception of Deferred tests approved in advance by the Owner.
- D. Commissioning will encompass and coordinate traditionally separate functions of system documentation, installation checkout, System Verification Checklists and start-up, control system calibration and point-to-point checkout, testing, adjusting, and balancing, Functional Performance Tests, Integrated System Tests, Contractor demonstration to the Owner, and training of Owner's personnel. This requires assembling all related documentation into one cohesive collection. Commissioning is intended to achieve the following specific objectives of the Contract Documents:
- E. Verify and document proper installation and intended performance of equipment, systems, and integrated systems.
- F. Ensure that operating and maintenance and Commissioning documentation requirements are complete.
- G. Provide the Owner with functional buildings and systems that meet the Contract Document requirements and the Owner's Project Requirements (OPR) at Substantial Completion.

- A. Basis of Design (BOD): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. Commissioning (Cx): A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial

- Completion, and the Contractor has provided the Owner adequate system documentation and training.

- N. Project Documents: Consists of the Contract Documents, Approved Submittals, Requests for Information (RFI), Vendor documentation, Operations and Maintenance (O&M) information and other documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the project.
- O. System Verification Checklist (SVC): A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the project through operational testing are performed in accordance with the requirements in the project documents.
- P. Start-up: The activities where equipment is initially energized, tested and operated. Start-up is completed prior to Operational Testing and Functional Performance Testing and is an integral item documented in the System Verification Checklist (SVC).
- Q. Training Plan: A detailed plan prepared by the Contractor and reviewed by the Owner and Commissioning Authority that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Commissioning Plan.
- R. Trending: Data collection of monitored points using the Building Automation System, Lighting Controls System, Power Status and Monitoring System or independent data acquisition instrumentation.

1.4 COMMISSIONING TEAM

- A. Owner shall appoint the following Members:
- 1) Owner's Project Manager and any other designated representatives of the Owner's staff.
 - 2) Commissioning Authority (CxA)
 - 3) Architect/Engineer (A/E)
 - 4) Test, Adjust and Balance Firm (TAB) – may be sub-contracted to the CxA
- B. Contractor shall appoint the following Members:
- 1) Individuals, each having authority to act on behalf of the entity they represent, explicitly organized to implement the Commissioning process through coordinated actions. At a minimum, the Contractor shall designate a Commissioning Coordinator and each major sub-contractor (Mechanical, Electrical, Plumbing, Building Automation) shall have a dedicated representative.
 - 2) Vendor representatives (as needed) required for start-up, operational testing, Functional Performance Testing, Integrated Systems Testing, and Owner Training activities.
 - 3) Representatives of independent testing agencies (Test, Adjust and Balance, Electrical Testing Agency, etc.)

1.5 ROLES AND RESPONSIBILITIES

- A. Roles and responsibilities of Commissioning Team members related to the Commissioning Process are provided in this Section. The respective entities defined below shall fulfill the listed roles and responsibilities as contained herein. Specific technical roles and responsibilities are defined in other sections of the Project Specifications.

B. Owner's Roles and Responsibilities:

- 1) Provide guidance in development of the Owner's Project Requirements (OPR).
- 2) Review Technical Specifications containing Commissioning requirements.
- 3) Approve the Commissioning Scope of Work and schedule of Commissioning activities.
- 4) Assign Owner's representatives and schedule them to participate in Commissioning activities, including the following:
 - a. Commissioning Team meetings.
 - b. Review and approval of the Commissioning Plan, Training Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, Final Commissioning Process Report, Systems Manual, Measurement and Verification Plan and other Commissioning documents.
 - c. Attend Owner Training sessions in operation and maintenance of systems and equipment.
 - d. Observation of Contractor's demonstration of systems and equipment operation.

C. Commissioning Authority's (CxA) Roles and Responsibilities:

- 1) Prepare the Commissioning Plan with the Owner's and Contractor's review and input.
- 2) Periodically attend and/or review the proceedings of the regular Construction Meetings hosted by the Contractor to understand the progress of construction activities on the project.
- 3) Conduct and document Commissioning Team meetings including the Commissioning Kickoff Meeting.
- 4) Perform site visits as necessary to observe component and system installations prior to energizing or start-up of equipment and systems.
- 5) Review and comment on product data and shop drawing submittals and coordination drawings applicable to systems being commissioned.
- 6) Following submittal review and approvals by the A/E team, review the sequences of operation and coordinate with the Contractor and A/E Team in order to prepare the Functional Performance Test Procedures and Integrated Systems Test procedures. Submit to the Owner and Contractor for review and comment prior to facilitating FPTs and ISTs on the project.
- 7) Upon written notice that equipment or systems are ready for initial energizing or start-up, review the progress of the System Verification Checklist(s) for the respective systems and components and ensure that all requirements have been completed by the Contractor to permit energizing or start-up in accordance with the project documents; CxA shall issue written notice to the Owner and Contractor that equipment is ready to energize or start-up. CxA will witness and ensure proper documentation is provided by the Contractor for major equipment energizing and start-ups as executed by the Contractor with appropriate notice as indicated herein.
- 8) Witness, verify, and document results of Functional Performance Tests and Integrated Systems Tests.

- 9) Coordinate resolution of deficiencies identified during site observations, equipment energizing or start-up, Functional Performance Testing, Integrated Systems Testing, Deferred Testing, and during the warranty period.
 - 10) Review the Operating and Maintenance (O&M) documents to ensure that as-built information and correct data is included prior to the Owner Training sessions; review final O&M submittal to ensure compliance with the requirements in the project documents and provide written comments to the Owner.
 - 11) Review the Contractor's Training Plan and individual training agendas for compliance with the requirements in the project documents. Recommend acceptance to the Owner prior to the Contractor scheduling training sessions with the Owner. Review the attendance and content of the training sessions to ensure the requirements of the project documents are completed. Conduct a survey of the Owner's personnel to evaluate the effectiveness of the Owner Training.
 - 12) Compile the Final Commissioning Process Report and submit to the Owner for review and approval.
- D. Architect/Engineer's (A/E) Roles and Responsibilities:
- 1) Specify control sequences of operation within the Contract Documents that comply with the OPR and BOD.
 - 2) Incorporate Commissioning requirements into the Contract Documents if requested by the Owner.
 - 3) Attend Commissioning Team meetings.
 - 4) Review the Commissioning Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, and other Commissioning documents as required by the Owner or the Contract Documents.
 - 5) Review Contractor's Training Plan and provide comments to the Owner.
 - 6) Approve technical requirements for correction of Deficiencies identified during Commissioning, Deferred Tests, and during the warranty period.
 - 7) Review Operating and Maintenance Manuals and provide comments to the Owner.
- E. Contractor's Roles and Responsibilities:
- 1) Contractor shall review and provide comments on documents produced by the Commissioning Authority, and shall accept the Commissioning Plan, System Verification Checklists, Functional Performance Test Procedures, and Integrated System Test Procedures as approved by the Owner.
 - 2) Provide an individual, subject to the Owner's approval, experienced in construction and Commissioning of building systems to organize, schedule, conduct, and document the Contractor's responsibilities in the Commissioning process. The Contractor shall assign this individual to act as the Contractor's Commissioning Coordinator. The Contractor's Commissioning Coordinator may have additional duties such as MEP Coordinator, but not as Project Manager or Superintendent. Submit qualifications demonstrating the Commissioning Coordinator's technical expertise and experience to the Owner for approval. In the event that Contractor chooses to subcontract its Commissioning obligations, then Contractor must submit the subcontractor's qualifications and personnel to Owner for Owner's approval.
 - 3) Furnish and install systems that meet all requirements of the Contract Documents.

- 4) Ensure that Commissioning Process activities are incorporated into the Master Project Schedule. The Contractor shall coordinate with the CxA and the Owner to determine the required activities, durations and predecessors.
- 5) Submit inspection requests, start-up requests and all supporting documentation in accordance with the Contract Documents, General Conditions, and Commissioning Plan.
- 6) Cooperate with Owner's representative(s), provide access to work and provide adequate labor, resources, and time for Commissioning.
- 7) Furnish copies of all shop drawings and submittals, manufacturers' literature, maintenance information, and any other information required for the Commissioning process. Contractor must submit to the Owner installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by the factory or field technicians. This requirement does not supersede any additional requirements contained in the Contract Documents.
- 8) Schedule and conduct pre-installation meetings and pre-commissioning meetings with subcontractors and equipment suppliers related to Commissioning. Contractor must invite Architect/Engineer, Owner and CxA to attend the pre-installation meetings and pre-commissioning meetings.
- 9) Provide qualified personnel, including subcontractors as required, to fully perform the testing and operational demonstrations required by the Contract Documents and the Commissioning Plan, including any Deferred Testing or re-testing related to warranty work.
- 10) Correct deficiencies identified during any stage of the Commissioning process.
- 11) Coordinate with the CxA to develop the Training Plan and submit to the Owner for approval. Provide training to the Owner's personnel in accordance with the Contract Documents and the approved Training Plan. Coordinate with the Owner to schedule training sessions and coordinate subcontractor/vendor participation in all training sessions.
- 12) Perform Deferred Testing and make necessary amendments to Operating and Maintenance Manuals and as-built drawings for applicable issues identified during the Deferred Testing.
- 13) Perform system maintenance during construction as specified and recommended by the Owner and send the maintenance records to the Owner for Record.
- 14) Document the equipment as it arrives onsite to ensure that the submitted and received equipment is correct as it arrives onsite, including the completion of the system verification sections pertaining to the procurement process.

1.6. SYSTEMS TO BE COMMISSIONED

1.6.1. The following systems shall be commissioned according to the process defined in this Section:

- 1.6.1.1. Major HVAC Systems (100% including but not limited to the list below)
 - 1.6.1.1.1 Air Handling Units
 - 1.6.1.1.2 Fan Coil Units
 - 1.6.1.1.3 Exhaust Fans
 - 1.6.1.1.4 Supply Fans
 - 1.6.1.1.5 Pumps
 - 1.6.1.1.6 Chillers
 - 1.6.1.1.7 Boilers

- 1.6.1.2. Terminal Units (10% Sampling)
- 1.6.1.3. Building Automation System
- 1.6.1.4. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)
- 1.6.1.5. Lighting - Daylight Controls (100%)
- 1.6.1.6. Lighting - Time Switch Controls (100%)
- 1.6.1.7. Normal and Emergency Power Systems

PART 2 - PRODUCTS

2.1. COMMISSIONING PLAN

- 2.1.1. Document developed by the CxA that provides the structure, schedule, and coordination plan for the Commissioning Process from the Pre-construction phase through the Occupancy Phase. The Commissioning Plan shall describe the project and systems to be commissioned, Commissioning Process activities and deliverables, procedures to follow throughout the process, specific roles and responsibilities for each participant, and general description of testing and verification methods.
- 2.1.2. The Commissioning Plan shall comply with the Owner's Project Requirements (OPR).
- 2.1.3. The Commissioning Team shall review the Commissioning Plan prior to the Pre-Commissioning Meeting and submit written comments or questions to the CxA to be addressed in the meeting.
- 2.1.4. Following the Pre-Commissioning meeting, the CxA shall incorporate all changes discussed and agreed upon in the Pre-Commissioning meeting and submit the Final Commissioning Plan to the Commissioning Team for approval and acceptance.
- 2.1.5. If changes to the Commissioning Plan are needed during the Commissioning Process, the CxA shall edit the plan and distribute to the Commissioning Team for approval and acceptance.
- 2.1.6. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor. The Contractor shall ensure that all sub-contractors and vendors agree and accept the Commissioning Plan.

2.2. SYSTEM VERIFICATION CHECKLISTS

- 2.2.1. System Verification Checklists (SVCs) are important to ensure that the equipment and systems are connected and operational and that Functional Performance Testing proceeds without unnecessary delays. These checklists document the inspections and procedures necessary to take a piece of equipment from a static state into an operating state. These checklists augment the manufacturer's start-up checklists to provide a complete document from procurement to the start of Functional Performance Testing when combined.
- 2.2.2. The CxA shall develop the System Verification Checklist templates for review by the Cx Team. The Contractor, appropriate Subcontractors and Vendors shall support the CxA in development of SVCs for each system and components by providing any necessary supporting documentation as requested by the CxA and reviewing and commenting on the checklist templates in accordance with the Project Specifications and the Commissioning Plan.
- 2.2.3. Once the checklist templates are reviewed and accepted, the CxA will produce checklists for all

equipment and components to be commissioned on the project utilizing an electronic commissioning database that is accessible via web portal or local field tool (i.e., iPad, tablet, laptop, etc.).

- 2.2.4. The CxA shall provide login access and training to the Contractor and other members of the Cx Team in the use of the electronic commissioning database.
 - 2.2.5. The Contractor shall be responsible for completing the required sections of the System Verification Checklists utilizing the electronic commissioning database and providing all supporting documentation via electronic transmittal to the CxA. Additional requirements for completion of the SVCs are included in this section and other technical sections of the Specifications.
 - 2.2.6. Once equipment arrives on the project site, the Contractor or sub-contractors shall begin completing the individual checklists and continue throughout the installation process. The checklists are meant to be progressive and a tool for tracking progress.
 - 2.2.7. Once the SVCs are electronically completed, the CxA will review and approve the checklists and supporting documentation and compile the information to include in the Final Commissioning Process Report.
- 2.3. FUNCTIONAL PERFORMANCE TESTING PROCEDURES:
- 2.3.1. The purpose of the Functional Performance Testing Procedures is to verify and document that the equipment and systems on the project individually perform in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.
 - 2.3.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of each piece of equipment and system. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.
 - 2.3.3. The Commissioning Team shall review the Functional Performance Test procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Functional Performance Testing review the procedures and provide comments.
 - 2.3.4. The CxA will coordinate with the Cx Team to address any comments and produce the final FPT procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.
 - 2.3.5. The Contractor shall utilize the FPT procedures for any pre-testing activities prior to Functional Performance Testing.
- 2.4. INTEGRATED SYSTEMS TESTING PROCEDURES:
- 2.4.1. The purpose of the Integrated Systems Testing Procedures is to verify and document that all the integrated equipment and systems on the project perform together in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.
 - 2.4.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of the integrated systems throughout the facility. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.

- 2.4.3. The Commissioning Team shall review the Integrated Systems Testing procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Integrated Systems Testing review the procedures and provide comments.
- 2.4.4. The CxA shall coordinate with the Cx Team to address any comments and produce the final IST procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.
- 2.4.5. The CxA shall also develop the IST personnel matrix that will be utilized to track the individual testing teams involved with the IST. The CxA will distribute the matrix to the Cx Team so that the Contractor and Owner can assign the appropriate personnel to the appropriate teams.
- 2.4.6. The CxA shall also host a coordination meeting prior to the IST to review the IST procedures, complete any final coordination, review safety procedures, and answer any questions.
- 2.4.7. The CxA estimates there will be two Integrated Systems Tests on the project. The first will test the Data Center systems separately and the second will test the entire facility. Requirements of the testing are included in the respective technical sections of the Project Specifications.
- 2.4.8. The IST procedures shall be utilized by the Contractor for any pre-testing activities prior to official Integrated Systems Testing.

2.5. TRAINING PLAN

- 2.5.1. Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training, after reviewing the different systems to be installed and commissioned. The purpose of the Training Plan is to specifically communicate the required content and training durations required by the Owner based upon the type of equipment and the Owner's past experience.
- 2.5.2. The Contractor shall review all of the individual technical sections of this specification for specific training requirements.
- 2.5.3. The Contractor shall coordinate with the Owner to ensure that the proposed training requirements meet the Owner's needs and expectations.
- 2.5.4. The Contractor shall coordinate with the sub-contractors and vendors to ensure the Owner Training requirements can be achieved and gather any additional information or recommendations.
- 2.5.5. Any changes to the training requirements in this specification must follow contractual protocols.
- 2.5.6. The Training Plan shall include a list of systems and equipment for which training will be provided according to the three-tiered training approach outlined in the project specifications.
- 2.5.7. All training sessions shall have a syllabus indicating the following as a minimum in addition to any other specification requirements:
 - 2.5.7.1. Session Objectives
 - 2.5.7.2. Proposed Instructor(s)
 - 2.5.7.3. Instructor Qualifications
 - 2.5.7.4. Training Materials that will be provided

- 2.5.7.5. Location and durations of the various parts of the training session (i.e., Classroom, On-site, etc.)
 - 2.5.7.6. Applicable specification sections and O&M Manual sections
 - 2.5.7.7. Detailed outline of training session content
- 2.5.8. The Contractor shall coordinate with the CxA to organize the systemic training sessions comparable to the organization of the Systems Manual.
- 2.5.9. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.
- 2.6. FINAL COMMISSIONING PROCESS REPORT
 - 2.6.1. The CxA shall prepare the Final Commissioning Process Report that will include the following:
 - 2.6.1.1. Executive Summary
 - 2.6.1.2. Participants and Roles
 - 2.6.1.3. Brief building description
 - 2.6.1.4. Overview of commissioning and testing scope
 - 2.6.1.5. General description of testing and verification methods
 - 2.6.1.6. Appendices with supporting information, issues log, and communications
 - 2.6.2. The Contractor shall coordinate with the CxA to provide any additional information that may be needed to complete the Final Commissioning Process Report.
 - 2.6.3. The Contractor shall resolve any outstanding commissioning items prior to the CxA preparing the final commissioning report.
 - 2.6.4. The CxA shall issue the Final Commissioning Process Report to the Cx Team for review. The Owner shall approve the Final Commissioning Process report after any comments or discrepancies are resolved by the CxA.

PART 3 - EXECUTION

- 3.1. PROJECT SCHEDULE
 - 3.1.1. The Contractor shall integrate all Commissioning activities into the detailed Project Schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to expedite the Commissioning Process.
- 3.2. COMMISSIONING TEAM MEETINGS
 - 3.2.1. Upon obtaining Owner's approval of the Commissioning Plan, the CxA shall coordinate with the Cx Team to schedule, plan, and conduct a Pre-Commissioning Meeting with all parties involved in the Commissioning process. This meeting should include the major subcontractors, specialty manufacturers/suppliers, Architect/Engineer, Test, Adjust, and Balance (TAB) Firm, Electrical

Testing Agency, and Owner's representatives as participants.

- 3.2.2. Contractor shall prepare for the Pre-Commissioning Meeting by supplying the following documents created by the CxA to all applicable sub-contractors and vendors: Commissioning Plan, Example System Verification Checklists, Example Functional Performance Test Procedures and Example Integrated Systems Test Procedures.
- 3.2.3. The CxA shall conduct the Pre-Commissioning Meeting and review all aspects of the Commissioning Plan and applicable specifications.
- 3.2.4. The Commissioning Plan shall be reviewed with all attendees and the scope of work discussed. Contractor should be prepared to distribute copies of the pertinent sections to the various subcontractors involved in the Commissioning process.
- 3.2.5. The final outcome of the meeting shall be an understanding of the commissioning process, roles and responsibilities, and consensus acceptance of the Commissioning Plan by the Cx Team.
- 3.2.6. The Contractor may request additional meetings with the CxA and individual sub-contractors to clarify roles, responsibilities and procedures as needed.
- 3.3. TEST EQUIPMENT
- 3.3.1. Contractor shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment.
- 3.3.2. All specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.
- 3.4. REPORTING
- 3.4.1. Beginning at the procurement stage for the equipment included in the Cx scope, the Contractor shall communicate at least monthly with all members of the Commissioning Team, keeping them apprised of construction progress and scheduling changes.
- 3.4.2. Contractor shall submit Deficiency reports to the Owner within five (5) days of the deficiency occurrence. This includes responses to items noted by the Commissioning Authority.
- 3.5. DEFICIENCY RESOLUTION
- 3.5.1. The CxA shall document any issues noted during observation or testing activities in the Commissioning Issues Log (CxIL). The CxIL shall be distributed electronically to the Cx Team at regular intervals.
- 3.5.2. The Contractor shall respond in writing to the CxA within 10 days to all new CxIL items regardless of the disposition. This response does not constitute a request for re-verification, only an acknowledgement of the outstanding item. The Contractor should utilize CxIL responses to update the Cx Team on the progress of deficiency resolution.
- 3.5.3. The Contractor shall respond to the CxA and the Owner indicating CxIL items that are completed and ready for the CxA to verify completion.

- 3.5.4. If any item indicated complete by the Contractor is found to be incomplete by the CxA upon re-verification the Contractor is responsible for all costs and additional compensation resulting from incomplete Cx Issues Log items.

3.6. REQUEST FOR ENERGIZING / START-UP OF EQUIPMENT

- 3.6.1. The Owner and/or Owner's representative may install lockout devices on equipment in addition to the Contractor's lockout / tagout devices once permanent power is connected to the facility. This lock would be removed once the proper start-up notification is received by the Owner and/or CxA, and the CxA has reviewed the appropriate SVCs and supporting documentation to verify the equipment is ready for energizing and/or start-up.
- 3.6.2. These requirements do not supersede any additional requirements noted elsewhere in the Contract Documents or as required by applicable code authorities.
- 3.6.3. Contractor shall notify Owner and CxA in writing to request initial energizing and/or start-up of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled start-up.
- 3.6.4. Contractor shall complete the applicable sections of the System Verification Checklist(s) evidencing the Contractor's thorough inspection of the system and readiness for start-up activities as required by the Project Documents and the Commissioning Plan. Contractor shall submit required supporting documentation to the Owner and/or CxA, including but not limited to, factory testing reports, alignment reports, electrical testing reports and any other documentation required by the Project Documents prior to energizing and/or start-up.
- 3.6.5. The CxA shall review the SVCs and supporting documentation within the 72-hour notice period and confirm in writing that the systems and equipment are approved to proceed with energizing and start-up.
- 3.6.6. The CxA and/or owner may witness equipment energizing and/or start-up at the scheduled time, but witness is not required, unless noted elsewhere in the Specifications, as long as written approval is received as noted herein.
- 3.6.7. Contractor shall perform Start-up under supervision of the responsible manufacturer's representative in accordance with manufacturer's instructions and Project Document requirements.
- 3.6.8. Contractor shall complete all required factory start-up documentation and applicable items in the System Verification Checklists, prior to startup, to ensure compliance with the requirements in the Project Documents.

3.7. OPERATIONAL TESTING

- 3.7.1. Once the appropriate start-up activities are completed, the Contractor shall complete all necessary operational testing requirements included in the Project Documents prior to Functional Performance Testing. Specific requirements for systems and equipment are included in other technical sections of the Specifications.
- 3.7.2. Contractor shall complete all operational testing items in the System Verification Checklist and submit all supporting documentation to the Owner and/or CxA for review.
- 3.7.3. Contractor and manufacturer's representatives shall supervise and coordinate adjustments and balancing of all devices and systems for proper operation prior to requesting a Functional Performance Test(s).

- ### 3.8. CONTROL POINT AND SENSOR CALIBRATION VERIFICATION

3.9. FUNCTIONAL PERFORMANCE TESTING

Performance Testing of equipment components and systems. The CxA shall facilitate the Functional Performance Testing activities according to the accepted FPT procedures and record the results of all testing activities.

- 3.9.5. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Functional Performance Testing.
- 3.9.6. All Functional Performance Testing of Integrated Systems must be completed in accordance with the Project Documents and the Commissioning Plan prior to the Contractor scheduling the Integrated Systems Testing activities.

3.10. INTEGRATED SYSTEMS TESTING

- 3.10.1. The objective of Integrated Systems Testing is to demonstrate that each integrated system operates jointly and/or independently of other systems according to the requirements in the Contract Documents.
- 3.10.2. Contractor shall operate each system, jointly and independently of other systems, through selected modes of operation (fire alarm integration with HVAC, emergency power modes, equipment failures among related systems, etc.) according to the accepted Integrated Systems Testing procedures developed by the CxA. The CxA shall facilitate and document the testing, organizing the appropriate testing teams and providing sufficient instruction to all participants to conduct efficient and effective testing activities.
- 3.10.3. Integrated Systems Testing typically involves multiple teams with representation from the CxA, Owner, and Contractor. The Contractor shall provide any needed communication equipment (i.e., radios) or make available any centralized intercom or paging system for communication with all testing groups.
- 3.10.4. The Contractor shall provide no less than 7 days (not including weekends or holidays) notice when requesting to conduct the Integrated Systems Testing. All personnel must be assigned to the Personnel Matrix by the CxA and a coordination meeting held within the 7 day period as prescribed elsewhere in this section.
- 3.10.5. Contractor conducts Integrated Systems Testing after all applicable Functional Performance Testing is satisfactorily completed and approved by the Owner and/or CxA.
- 3.10.6. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Integrated Systems Testing.

3.11. DEMONSTRATION AND OWNER TRAINING

- 3.11.1. The Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training as required throughout various sections of the Project Specifications.
- 3.11.2. The specific requirements for scheduling and conducting the Owner Training are included in other sections of this Specification.

- 3.11.3. Owner Training activities shall not occur until the Training Plan is approved by the Owner and the Contractor has submitted all O&M information for review and use during the training sessions.
 - 3.11.4. The Contractor shall notify the CxA of all training sessions. The Contractor shall record attendance of the training sessions and the Owner shall ensure the appropriate personnel are in attendance.
 - 3.11.5. The CxA shall ensure the content of the Owner Training sessions meets the requirements in the Project Documents.
 - 3.11.6. The CxA may conduct surveys of the Owner's personnel to gauge the effectiveness of the Owner training sessions. If unfavorable surveys are received by the Owner's personnel indicating unsatisfactory training, the Owner reserves the right to require the Contractor to re-train in those specific areas of non-conformance until the requirements in the Project Documents are satisfactorily completed.
 - 3.11.7. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.
- 3.12. DEFERRED / SEASONAL TESTING
- 3.12.1. All Construction phase requirements of the Commissioning Process must be completed prior to Substantial Completion or as indicated elsewhere in this Specification.
 - 3.12.2. If any testing or other requirements cannot be completed prior to Substantial Completion due to the building structure, required occupancy condition, or other condition, performance of such test may be delayed to later in the warranty period, upon approval of the Owner. Contractor shall reschedule testing according to the protocols described in this section and any other operational protocols prescribed by the Owner.
 - 3.12.3. Contractor shall complete all outstanding commissioning requirements as part of this Contract during the warranty period. Contractor shall schedule all activities with Owner and/or CxA.
 - 3.12.4. The CxA shall document any deferred testing activities and ensure the appropriate commissioning documents are updated. The Contractor shall provide any additional documentation needed by the CxA to complete these requirements.

END OF SECTION

**SECTION 02 4100
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements, furniture and equipment for alterations purposes.

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 portions of existing walls as indicated on the drawings.
- B. Remove portions of existing ceilings as indicated on the drawings.
- C. Remove other items indicated, for salvage, relocation, and recycling.
- D. 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 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 equipment as 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.

3.04 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 03 1000
CONCRETE FORMING AND ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in place concrete.
- B. Form accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Concrete Construction; 2020.
- C. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- D. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- E. PS 1 - Structural Plywood; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, arrangement of joints and ties, and minimum soil retainer bearing lengths above the bottom of the grade beam and below the bottom of the void as calculated per the formwork accessories section below.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.
- C. Protect plastic foam products from damage and exposure to sunlight.

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 relevant portions of ACI 301, ACI 301, and ACI 301.

2.02 WOOD FORM MATERIALS

- A. Wood forms for unexposed concrete surfaces - No. 2 Common Southern Yellow Pine Lumber or other material of equal qualifications of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces.
- B. Wood forms for exposed concrete surfaces - Commercial Standard Douglas Fir, moisture-resistant, concrete form plywood with one smooth face.

2.03 FORMWORK ACCESSORIES

- A. 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. Composition: Colorless mineral oil-based compound.
- B. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- C. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/2 inch thick and full depth of slab less 1/2 inch .
- D. Waterstops: See section 03 3000 - Cast-in-Place Concrete.
- E. Expanded Polystyrene (EPS) Geofoam:
 - 1. Lightweight expanded polystyrene with a minimum compressive strength of 2.2 pounds per square inch (psi) at a 1% deformation.
 - 2. Geofoam shall be in compliance with ASTM D 6817.
 - 3. Geofoam shall be shaped to provide continuous support for raised slabs or to act as a lightweight fill material at locations indicated on the drawings.
 - 4. Manufacturers:
 - a. Foam-Control EPS Geofoam, AFM Corporation: www.geofoam.com
 - b. InsulFoam GF, Insulfoam, LLC.: www.insulfoam.com
 - c. Therma Foam: www.thermafoam.com

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 formed grade beams allowed only where noted in the Structural Drawings. Grade beams shall be FORMED ON ALL structural slabs and exposed conditions. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 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. Refer to the Civil Drawings for construction joint requirements at flatwork.
- E. Construction joints: Locate construction joints in concrete as indicated. Contractor shall obtain written approval for all construction joints not shown on Drawings for structural concrete. Distance between construction joints shall be arranged so that the greatest horizontal dimension (including diagonal measurement) for slab pours shall not exceed 200 feet. Provide keyways and extra dowels at all joints. Provide longitudinal keys at joints.
- F. Expansion joints: Expansion joints shall consist of joint fillers with sealant. Install filler strips 3/4" below finished surfaces. Clean grooves when surface is dry of foreign matter, loose particles and concrete protrusions; then fill approximately flush with joint sealant to be slightly concave after drying. Finish edges of exposed concrete along expansion joints around all fixed objects within or abutting concrete.

- G. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

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 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
- B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.06 FIELD QUALITY CONTROL

- A. A special inspections and testing agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.
- 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.

3.07 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

**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.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Concrete Construction; 2020.
- B. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
- F. CRSI (DA4) - Manual of Standard Practice; 2009.
- G. CRSI (P1) - Placing Reinforcing Bars, 10th Edition; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, location of splices and embedded metal assemblies.
- 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 318, ACI 318, ACI 301, ACI 318, and ACI 318.
 - 1. Maintain one copy of each document on project site.
- B. Provide Architect with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
 - 3. Splicing of pier reinforcement shall not be permitted.
- B. Weldable Reinforcing Steel: ASTM A 706, deformed low-alloy steel bars.
 - 1. Unfinished.

- C. Steel Welded Wire Reinforcement (WWR): Plain Type; 1.
 - 1. Form: Flat Sheets.
- D. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. At slabs, supports shall not be further than 48 inches apart, each way.
 - 3. Provide plastic or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI SP-66 - ACI Detailing Manual.
- B. Welding of reinforcement is not permitted, unless explicitly indicated on Structural Drawings
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 - 1. Review locations of splices with Architect.
 - 2. Approved patented type splices (No Electric Arc Welding Permitted) may be used instead of lap splices.
 - 3. Any bar may be field bent one time without notifying the Structural Engineer, unless noted otherwise on the Structural Drawings. Reinforcement smaller than #4 bars shall be cold bent. Reinforcement greater than #4 bars shall be bent with heat in the field. Heating shall be controlled by temperature indicating crayons and shall reach a maximum temperature of 1500 degrees Fahrenheit. Reinforcement shall not be artificially cooled until temperature has reduced naturally to below 600 degrees Fahrenheit. Bends shall be gradual and care shall be taken to prevent heating or cracking of concrete. If reinforcement must be field bent more than once, the Contractor shall issue an RFI indicating which bars need to be field bent additionally.

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. Placement of reinforcing steel shall be done in cooperation with requirements of other trades. No cutting of reinforcement or displacement of bars shall be done by any of the trades without the consent of the Architect, and then only when adequate reinforcement is provided to replace the design requirements.
- E. Use templates to locate all column and footing dowels.
- F. Maintain concrete cover around reinforcing as indicated on drawings.
- G. Bond and ground all reinforcement to requirements of Section 26 0526.

3.02 FIELD QUALITY CONTROL

- A. A special inspections 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 03 3000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floors and slabs on grade.
- B. Concrete Floor Topping and Feathering Material.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.
- E. Concrete curing.
- F. Concrete Mix Design Requirements

1.02 COORDINATION OF CIVIL AND STRUCTURAL CONCRETE SPECIFICATIONS

- A. This specification section applies to all concrete designs provided on the Structural Drawings. For clarification, this specification section applies to interior and exterior concrete designs provided on the Structural Drawings (possibly including but not limited to sidewalks, patios, pavement, ramps, stairs, retaining walls, etc.). For exterior concrete designs not shown on the Structural Drawings but shown on the Civil Drawings, the provisions of this specification section only applies when there is not a conflicting specification elsewhere in the Project Manual or Civil Drawings.

1.03 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 03 3543 - Bonded Abrasive Polished Concrete Floors

1.04 REFERENCE STANDARDS

- A. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials; 2006.
- 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 SPEC-301 - Specifications for Concrete Construction; 2020.
- E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- F. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- J. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- L. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.

- M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- N. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.
- O. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.
- Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004, with Editorial Revision (2013).
- R. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2019).
- S. 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.
- T. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
- U. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2020.
- V. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.
- W. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop; 1974.
- X. ICC-ES AC308 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).
- Y. NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. The Contractor shall submit all proposed mix designs in accordance with ACI 301 to the Architect for review before use. Each mix design shall clearly identify where the Contractor proposes use, such as indicating "Drilled Piers", "Auger Cast-In-Place Piles", "Concrete Columns", "Insulating Concrete Formed Walls", "Cast-In-Place Concrete Retaining Walls", "Precast Tilt Wall Panels", "Light Pole Bases", "Grade Beams", "Interior Slabs on Grade & Interior Slabs on Metal Deck", "Interior Slabs on Void Boxes and Interior Slabs on Temporary Formwork", "Exterior Slabs on Grade, Exterior Slabs on Metal Deck and Miscellaneous Concrete", "Exterior Slabs on Void Boxes and Exterior Slabs on Temporary Formwork", "Storm Shelter Roof Topping Slab", "Greenhouse Foundations", "Freezer Slabs & Cooler Slabs", "Crawlspace Mudslab", etc. Failure to clearly identify where mixes are proposed for use is a suitable reason for rejection. To expedite approval it is suggested that all mix designs related to Structural items be submitted separately from all mix designs related to Civil items as these two categories are reviewed by different parties. Furthermore, to expedite approval, it shall be permitted to email Structural Mix Designs directly to the Structural Engineer or Record and request approval.
- C. It shall be required to submit new mix designs for approval when changes to brand, type, size, or source of cementitious material, aggregates, water, ice, or admixtures are proposed or necessary.
- D. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, refer to Submission requirements below before products shall be permitted and provide letters of acceptance from the flooring subcontractor and provide data on method of removal in the event of incompatibility with floor covering adhesives.
2. Concrete Admixtures: For each proposed mix design, provide a written statement from each admixture manufacturer that is used in the concrete mixture that:
 - a. Each mixture meets the governing ASTM standing for the admixture.
 - b. The manufacturer's understanding of the intended use of the admixture (e.g. air entraining agent, water reducing agent, retarding agent, etc.), the manufacturer's understanding of the purpose range of dosages in the concrete mixture, and that the manufacturer recommends the use of the proposed admixture(s) or the intended purpose.
 - c. Each proposed admixture is compatible with each of the constituents of the mixture (e.g Type of cement, and supplementary cementitious materials, other proposed admixtures in the mix, etc).
 - d. The proposed combination of admixtures will not result in effects that are detrimental to the strength, workability, or durability of the concrete.
 - e. The proposed combination of admixtures will not increase the shrinkage potential of the concrete mixture from that of the concrete mixture without any admixtures.
 - f. The use of the proposed admixtures will not cause the concrete to have a chloride ion content greater than specified.
 - g. The proposed admixtures do not contain more than 25% lignosulfonates.
- E. Saw-Cut Plans: Submit proposed saw-cut locations for slab on grade and topping slabs to the architect and structural engineer of record. Saw-cuts in slab over void space are not permitted.
- F. Control Joint Plans: Submit proposed control joint locations to the structural engineer of record.
- G. Samples: Submit samples of underslab vapor barrier and tape to be used if making a substitution request.
- H. Test Reports: Submit report for each test or series of tests specified.
- I. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
 1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. For slabs that require under slab vapor barriers, Contractor shall contact manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

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 or ASTM C 1157, Type I/II Portland type.
 1. Acquire cement for entire project from same source.

- B. Blended Hydraulic Cement: ASTM C595/C595M, Type IL Portland-Limestone Cement
 - 1. Acquire cement for the entire project from the same source.
- C. Fine and Coarse Aggregates: ASTM C33/C33M (Except as Noted)
 - 1. Acquire aggregates for entire project from same source.
 - 2. Fine aggregate:
 - a. Provide washed natural or manufactured sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
 - 3. Coarse aggregate:
 - a. Provide coarse aggregate consisting of clean, hard, find grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight of flat, chip-like, thin, elongated, friable, or laminated pieces, nor more than 2% by weight of shale or cherty material.
 - b. Unless noted otherwise, the nominal aggregate size shall be the largest practicable size for each condition of placement, subject to the lesser of the following maximum size limitations:
 - 1) 3/4" for slabs over void boxes
 - 2) 1/2" for Tilt-up concrete wall panels
 - 3) 3/8" for ICF walls
 - 4) In all cases, do not exceed 3/4 of the clear distance between reinforcing bars, 3/4 of the specified clear cover, 1/5 of the narrowest dimension between sides of forms, or 1/3 of the depth of any slab section.
 - c. For each mix design submittal (excluding pavement designed by the Civil Engineer and shown on the Civil Drawings): The concrete supplier shall provide a combined (coarse and fine) sieve analysis for the proposed aggregate blend, using sieve data measured within the past 3 months. It shall be permitted for the concrete supplier to submit a combined sieve analysis that is calculated based on individual sieve analyses.
 - 1) The combined sieve analysis shall show the percent retained on each sieve (not the cumulative percent retained) and shall meet the following requirements:
 - (a) Sizes: 1 1/2", 1", 3/4", 1/2", 3/8", #4, #8, #16, #30, #50, #100, #200.
 - (b) No sizes other than those listed shall be on the analysis.
 - (c) 0% shall be retained on the 1 1/2" sieve.
 - (d) 0% to 16% shall be retained on the 1" sieve.
 - (e) 0% to 20% shall be retained on the 3/4" sieve.
 - (f) 4% to 20% shall be retained on the 1/2", 3/8", #4, #30, and #50 sieves.
 - (g) 0% to 12% on the #8 and #16 sieves.
 - (h) 0% to 16% shall be retained on the 1" sieve.
 - (i) 5% to 10% shall be retained on the #100 sieve.
 - (j) 0% to 2% on the #200 sieve.
 - (k) The combined percent retained on the #30, #50, #100, and #200 sieve shall be 25% to 40%.
 - (l) The combined percent retained on the #8, #16, and #30 sieves shall not be greater than 20%.
 - (1) Exception: The percent retained shall be 0% for all sieves larger than the specified nominal maximum aggregate size for an individual mix.
 - 2) If the percent retained requirements above cannot be met by using multiple aggregate piles from the plant, the Contractor shall assume for bidding purposes that outside sources will be required.
 - 3) The requirements of the combined sieved analysis set forth in item 1 may exceed or be more stringent than the requirements set forth in ASTM C33/C33M

- 4) When concrete is pumped, the inside diameter of the pipeline shall be a minimum of 3-times the specified maximum nominal aggregate size. Do not use smaller aggregate sizes to accommodate smaller pipe diameters.
- D. Lightweight Aggregate: ASTM C330/C330M.
- E. Fly Ash: ASTM C618 C or F
- F. Water: ASTM C94/C94M or potable.
- G. Concrete Floor Topping and Feathering Material:
 - 1. This item applies to concrete topping slabs with a thickness of 3-inches or less
 - 2. At feathered locations, provide cement-based self-leveling underlayment.
 - 3. Provide manufacturer's recommended primer for standard absorbent concrete.
 - 4. Aggregate shall be well graded, washed gravel (1/8" to 1/4" or larger) for use when underlayment is installed over 1 1/2" thick.
 - 5. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).
 - 6. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following manufacturers.
 - a. Ardex Engineered Cements: www.ardex.com
 - b. (Level-Right) Maxxon Corporation: www.level-right.com
 - c. Bonsal American: www.bonsal.com
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in, including calcium chloride, excess of 0.1 percent by weight of cement.
- B. Dispense in compliance with manufacturer's recommendations with particular attention to possible undesirable chemical reaction between products when mixed in concentrated form.
- C. Do not use admixtures that contain more than 25% lignosulfonates.
- D. Do not use admixtures or a combination of admixtures that will increase the shrinkage potential of concrete.
- E. Air Entrainment Admixture: ASTM C260/C260M.
- F. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
 - 1. Manufacturers:
 - a. MasterGlenium 1466 by BASF Corporation.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- G. Mid-Range Water Reducing Admixture: Complying with ASTM C494/C494M Type A and/or Type F and having a maximum of 25% lignosulfonates.
 - 1. Manufacturers:
 - a. POLYHEED 1020 by Degussa Admixtures
 - b. SIKAMENT 686 by Sika (214) 878-3669
 - c. PLASTOL 341 by Euclid Chemical Co. (216) 531-9222
 - d. POZZOLITH 200N by BASF Corporation
 - e. MasterGlenium 1466 by BASF Corporation
 - f. Substitutions: See Section 01 6000 - Product Requirements. A letter from the manufacturer will be required indicating that the material does not have more than 25% lignosulfonates.

2.05 ACCESSORY MATERIALS

- A. At slabs over crawlspace, unless specifically noted otherwise, crawlspace shall consist of 3" thick unreinforced mud slab. If crawlspace grading indicates locations where mud slab is not required, provide vapor barrier noted above covered with 2" of 3/8" diameter pea gravel.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Waterstops: Self-sealing, non-swelling preformed joint sealant.
 - 1. Single component, self-sealing adhesive compound, extruded in a square cross-section between two quick-release protective wrappers.
 - a. Meets Federal Specification SSS-210
 - b. Certified NSF/ANSI Standard 61 for use in potable water systems
 - c. Manufacturers:
 - 1) Henry Company; Synko-Flex Waterstop: www.us.henry.com
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Flexible PVC Waterstop. Dumbbell Configuration.
 - a. Certified NSF/ANSI Standard 61 for use in potable water systems
 - b. Manufacturers:
 - 1) Sika USA; Greenstreak Waterstop: usa.sika.com
 - 2) Substitutions: See Section 01 6000-Product Requirements.
- D. Reglets: See Section 03 1000 - Concrete Forming and Accessories
- E. Joint Filler: See Section 03 1000 - Concrete Forming and Accessories
- F. Slab Construction Joint Devices: See Section 03 1000 - Concrete Forming and Accessories

2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
 - 1. Manufacturers:
 - a. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
- B. At all building slabs, except locations where a "sealer" is shown on the Architectural Drawings: Wet Curing with Potable Water that is not detrimental to concrete.
 - 1. Unless otherwise approved as a substitution request, Proposers shall assume for Proposal purposes that curing compounds shall not be used anywhere on this project and that only wet curing shall be permitted. However, if requested as a substitution request, the Architect may elect to permit this material at certain locations if the Contractor verifies that the warranty will be met: Curing Compound, Naturally Dissipating, Clear, water-based, liquid membrane-forming compound, that dissipates within 3 to 5 weeks; complying with ASTM C309. Note: Many flooring installer Subcontractors will no longer warranty flooring if any kind of curing compound is used! It is the Contractor's responsibility for verifying compatibility of flooring materials and adhesives with any proposed curing compound before proposing curing compounds.
- C. At all building slabs where a "sealer" is shown on the Architectural Drawings: Curing and Sealing Compound, Semi-Gloss: Liquid, membrane-forming, dries clear, non-yellowing acrylic-based polymer; complying with ASTM C1315 Type 1 Class A.
 - 1. Vehicle: Solvent-based.
 - 2. Solids by Mass: 25 percent, minimum.
 - 3. VOC Content: Ozone Transport Commission (OTC) compliant.
 - 4. Manufacturers:
 - a. BASF; MasterKure CC 250 SB: www.master-builders-solutions.basf.us
 - b. W.R. Meadows, Inc.; CS-309-25 OTC: www.wrmeadows.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.08 CONCRETE MIX DESIGN REQUIREMENTS

- A. Note to Building Official: The specified air contents for this project are based on the interpretation that all concrete on this project is under Exposure Category F0 conditions in which Freezing and Thawing concerns are "Not Applicable". The International Building Code requires that air contents of concrete be within ranges specified by ACI 318 for various Exposure Categories depending on the probability of exposure to moisture before freezing, and probability of cycles of freezing and thawing. ACI Commentary describes F0 as concrete that will not be exposed to cycles of freezing; F1, exposed to cycles of freezing and thawing that will be occasionally exposed to moisture before freezing; F2, exposed to cycles of freezing and thawing that is in continuous contact with moisture before freezing; and F3, similar to F2 with exposure to deicing chemicals. The "not applicable" interpretation for this project is based on the very limited number of freeze thaw cycles that are likely to occur at this project and based on the consideration that high air contents can cause problems such as cracking and surface delamination.
- B. Refer to the schedule of mixes at the end of this specification section for requirements specific to different applications. It shall be permitted to submit to the Engineer any desired proprietary designs which deviate from the schedule of mixes if and only if all deviations from the schedule are clearly noted and if test data is provided indicating the performance of the concrete with regard to slump versus time, strength versus time, and air content.
- C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- D. Establish required average strength for each type of concrete on the basis of field experience, as specified in ACI 301. It shall be an obligation of the Contractor to produce and deposit concrete that will exceed specified strength twenty-eight days after placing. Concrete falling below specified strength required by ACI 318, as shown by cylinder test shall be removed by the Contractor and be replaced with concrete at specified strength at no cost to the Owner unless otherwise approved by the Engineer after evaluation.
- E. Concrete may be proportioned and mixed at the job, dry-batched and mixed at the job or be procured from a ready-mixed concrete plant. Whatever the method of production, concrete materials and concrete shall be stored handled and mixed in conformance with all requirements of ASTM C94, which apply to the particular method selected.
- F. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- G. Aggregate: As specified in Section 2.03 B.

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. Formwork: Comply with requirements Section 03 1000 - Concrete Forming and Accessories.
- B. 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.

3. At intersections of pours for concrete walls and beams (including foundation elements such as grade beams), install a 1 1/2" deep keyway that is a minimum of 1/3 the thickness and 1/3 the height (unless otherwise noted) and roughen the exposed surface of the first pour with a minimum 1/4" amplitude.
- C. 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.
- D. Vapor Barrier: At exterior floor slabs where indicated on the Structural Drawings Sheets and Notes and at all interior floor slabs, a vapor barrier under the floor slab shall be installed in accordance with ASTM E 1643 and as indicated in Part 2 of this Specification Section. Lap joints minimum 6 inches. Repair damaged vapor retarder before covering.
 1. Install compactible granular fill before placing vapor barrier at areas where slabs are poured on grade. Install void boxes and masonite before placing vapor barrier at areas where slabs are to be poured on void boxes. Do not place sand between the vapor barrier and the slab.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of Section 03 2000 - Concrete Reinforcing.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R and ACI 302.2R
- C. Notify Architect not less than 48 hours prior to commencement of placement operations.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 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.
- D. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- E. Separate slabs on grade from vertical surfaces with joint filler as indicated on drawings.
- F. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- G. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 9200 for finish joint sealer requirements.
- H. Install joint devices in accordance with manufacturer's instructions.
- I. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- J. Install joint device anchors for expansion joint assemblies specified in Section 07 9513. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- K. Apply sealants in joint devices in accordance with Section 07 9200.

- L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- M. Place concrete continuously between predetermined expansion, control, and construction joints.
- N. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within sections.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Placing of concrete in supported elements shall not be started until concrete previously placed in columns and walls is no longer plastic.
- Q. Consolidate concrete by vibration, spading or rodding, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners or forms, eliminating all air or stone pockets that may cause honeycombing, pitting or planes of weakness.
- R. Place saw-cuts in slabs-on-grade and topping slabs in saw cut pattern indicated. Saw-cuts in slab over void space are not permitted.
- S. Saw cut slab-on-grade and topping slab joints within 4 hours after placing. Use maximum 3/16 inch thick blade, cut into slab 1/4 depth of slab thickness. Saw-cuts in slab over void space are not permitted.
- T. Screed slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.06 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.
- E. Place concrete floor toppings to required lines and levels.
- F. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
 - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
 - 3. Under Carpeting: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. 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.

3.08 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 indicated on drawings and 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.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; 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 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 3. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
 4. Broom Finish: Ramps, stair treads, sidewalks, porches and docks, concrete pads, Storm Shelter Roof Topping and bases for mechanical equipment. Steel trowel smooth. Brush after troweling with a soft bristle broom to create non skid surfaces perpendicular to the direction of travel.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.09 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. 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. Floor and Roof Slabs To Receive Adhesive-Applied Flooring or Roofing: Curing compounds and other surface coatings are usually considered unacceptable by flooring manufacturers, adhesive manufacturers, and roofing installers. If use of such materials is desired by the Contractor, the Contractor shall either obtain the approval of the flooring manufacturer and adhesive manufacturers, or roofing installer prior to use. Alternatively, the Contractor shall remove the surface coating after curing to flooring manufacturer's or roofing installer's satisfaction. Unless otherwise approved as a substitution request, the Contractor shall assume during bidding that curing compounds shall not be used anywhere on this project and that only wet curing shall be permitted. However, if requested by the Contractor as a substitution request or during construction, the Architect may elect to permit this material at certain locations. Generally, the Architect will require a letter from the flooring subcontractor or roofing installer guaranteeing that the curing compound is compatible with the flooring adhesive and flooring materials or roofing system.
 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven days or until the concrete has reached 70% of the specified 28-day strength 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.
 - b. Spraying: Spray water over floor slab areas and maintain wet.
 - c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3.10 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. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

3.11 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.

3.12 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.13 SCHEDULE - CONCRETE MIX DESIGN REQUIREMENTS

- A. "Interior Slabs on Grade" Mix: 3,000 psi 28 day concrete, maximum water to cement ratio of 0.5, 5" to 6" slump (Note: This is more stringent than the default ACI tolerance for slump), 1.5% +/- 1.5% air content, air entraining agent not permitted, minimum 5 sacks of cement per cubic yard with up to 20% replacement using Class F fly ash permitted, mid range water reducing agents permitted, high range water reducing agents not permitted. The slab aggregate gradation requirements in Section 2.03 B shall apply. If any portion of concrete is will be permanently in contact with exterior elements, Miscellaneous Concrete mix design shall apply.
- B. "Exterior Slabs on Grade, and Miscellaneous Concrete" Mix: 3,000 psi 28 day concrete, maximum water to cement ratio of 0.50, 5" to 6" slump (Note: This is more stringent than the default ACI tolerance for slump), 4.5% +/- 1.5% total air content using air entraining agent, minimum 5 sacks of cement per cubic yard, up to 20% cement replacement using Class F fly ash permitted, Class C fly ash not permitted unless it also qualifies as a Class F fly ash, mid range water reducing agents permitted, high range water reducing agents not permitted. The slab aggregate gradation requirements in Section 2.03 B shall apply.

END OF SECTION

**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.

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.

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; 2023.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.
- 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; 2020.
- 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 Method for Measurement of Masonry Flexural Bond Strength; 2013, with Editorial Revision (2014).
- P. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).
- Q. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.
- R. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.

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 C476 and 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: Match Existing.

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 accordance 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"	3/4"	1 1/2" x 2"
	5'-0"	2"	2" x 3"
	12'-0"	2 1/2"	2 1/2" x 3"
	24'-0"	3"	3" x 3"
Coarse	1'-0"	1 1/2"	1 1/2" x 3"
	5'-0"	2"	2 1/2" x 3"
	12'-0"	2 1/2"	3" x 3"
	24'-0"	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: To be selected from manufactures standard colors unless specifically scheduled on the drawings.
 - 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 2500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
- G. Section 07 6200 - Sheet Metal Flashing and Trim: Metal through-wall masonry flashings.
- H. 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. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- D. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- E. NCMA TEK 19-7 - Characteristics of Concrete Masonry Units with Integral Water Repellent, 2008
- F. 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. Best Block Construction Materials: www.bestblock.com.
 - 2. Boral Concrete Products: www.boralconcreteproducts.com
 - 3. Oldcastle Architectural, Jewell Concrete Products: www.jewellcp.com.
 - 4. Spectra Development Corporation: www.spectraglaze.com.
 - 5. Texas Building Products, Inc.: www.texasbuildingproducts.com.
 - 6. Trenwyth Industries, Inc.: www.echelonmasonry.com.
 - 7. 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.sioxcitybrick.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: King Size.
 3. 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. PROSOCO, Inc: www.prosoco.com.
 4. WIRE-BOND www.wirebond.com/#sle.
 5. 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, 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 B. Mill-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 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 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, Inc., 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. Through Wall Flashing Materials: Products as specified in Sections 07 2500 and 07 6200.

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) CavClear Inc., CavClear Masonry Mat MDCD, www.CavClear.com.
 - 2) Hohmann & Barnard, Inc; Mortar Trap: www.h-b.com/sle.
 - 3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
 - 4) 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.
 - 1. Place the vent material into joint, directly on top of flashing material, prior to installing the second masonry unit.
 - 2. Install the weep vents as the wall is being erected so joints do not become filled with mortar or debris.
 - 3. 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. Coordinate masonry work with installation of metal and membrane through wall flashings in accordance with Sections 07 2500 and 07 6200.
- B. Laying Masonry Walls at Flashings:
 - 1. 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.
 - 2. At wall base flashings, place mortar bed on top of flashing.

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 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members and support members.
- B. Base plates, shear stud connectors and expansion joint plates.
- C. 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.
- C. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- I. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2014.
- J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
- K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).
- L. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2015.
- M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- N. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.
- O. 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.
- P. 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; 2019, with Editorial Revision (2020).
- Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2015, with Editorial Revision (2018).

- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- T. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with Errata (2015).
- U. UL (FRD) - Fire Resistance Directory; Current Edition.

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 and the calculations for the design of these connections.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 5. 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 Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Maintain one copy of each document on site.
- C. Fabricator: Company specializing in performing the work of this section with minimum three years of documented experience.
- D. Erector: Company specializing in performing the work of this section with minimum three years of documented experience.
- E. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Plates: ASTM A36/A36M
- B. Steel Angles: ASTM A36/A36M or ASTM A572/A572M, Grade 50
- C. Steel W Shapes and Tees: ASTM A992/A992M.
- D. Steel C and MC Channels: ASTM A992/A992M.
- E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
- F. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.
- G. Steel Bars: ASTM A108 Grade 50.
- H. Steel Plate: ASTM A514/A514M.

- I. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
- J. Pipe: ASTM A53/A53M, Grade B, Finish black.
- K. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- L. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- M. Headed Anchor Rods: ASTM F 1554, Grade 55, plain as indicated on the drawings.
- N. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- O. Sliding Bearing Plates: Teflon coated.
- P. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- Q. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- R. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Space shear stud connectors at as indicated on the drawings.
- C. Continuously seal joined members by intermittent welds and plastic filler. Grind exposed welds smooth.
- D. Fabricate connections for bolt, nut, and washer connectors.
- E. Develop required camber for members.

2.03 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3, Power Tool Cleaning.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

- A. 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. Source quality control testing is not required for any steel provided by an AISC certified steel fabrication shop.

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 and shear studs 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. 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 05 4000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall and interior wall framing, both load-bearing and non-load-bearing, including soffit framing and other non-structural miscellaneous framing.
- B. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing.
- B. Section 05 3100 - Steel Decking.
- C. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 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 framing connectors, showing compliance with requirements.
- D. 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, floor joist, ceiling joist, roof rafter, and roof truss layout.
 - 2. Describe method for securing studs and all of the cold formed metal framing to tracks and any other boundary supports all framing connections.
 - 3. Design data:

- 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.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.07 MOCK-UP

- A. 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.
- B. Mock-Up Size: 4 by 4 feet, including corner condition.
- C. Location: As directed.
- D. Mock-up may not remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. CEMCO: www.cemcosteel.com.
 - 2. ClarkDietrich Building Systems: www.clarkdietrich.com.
 - 3. MarinoWARE: www.marinoware.com/#sle.
 - 4. Mill Steel Company: www.millsteelframing.com
 - 5. Telling Industries, LLC: www.buildstrong.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing.
 - 2. Simpson Strong Tie: www.strongtie.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, straight and curved track, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Requirements: Provide completed framing system having the following characteristics:
 - 1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
 - 2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
 - 3. Design Loads: As indicated on the drawings.
 - 4. Wind and Live load deflection meeting the following, unless otherwise indicated:
 - a. Floors: Maximum vertical deflection under live load of 1/360 of span.

- b. Roofs: Maximum vertical deflection under live load of 1/180 over areas without a ceiling, 1/240 over areas with a nonplaster ceiling and 1/360 over areas with a plaster ceiling.
- c. Interior Walls that have no exposure to exterior wind pressures: Maximum horizontal deflection under interior wind pressures of 1/360 of span.
- d. Exterior Walls: Maximum horizontal deflection under service level Components and Cladding wind load of 1/600 of span where masonry veneer or plaster is outside of the stud wall and 1/360 of span where metal panel or flexible finishes are outside of the stud wall.
- 5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- 6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- C. Shop fabricate framing system to the greatest extent possible.
- D. Deliver to site in largest practical sections.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage and depth: Minimum 18 gage thickness for exterior walls, and depth as shown on the drawings. Minimum 25 gage thickness for interior walls, and depth as shown on the drawings. The Cold Formed Metal Framing Engineer may increase the gage and decrease the spacing as required for design but may not increase the depth as shown on the drawings.
 - 2. Galvanized in accordance with ASTM A653/A653M, G60/Z180 coating.
 - 3. Provide components fabricated from ASTM A 1008/A 1008M, Designation SS steel.
- B. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G60/Z180 hot dipped galvanized coating.
 - 1. Base Metal: Structural Steel (SS), Grade 33/230.
 - 2. Gage and depth: Minimum 18 gage thick, and depth as shown on the drawings. The Cold Formed Metal Framing Engineer may increase the gage and decrease the spacing as required for design but may not increase the depth as shown on the drawings.
- C. Framing Connectors: Factory-made, formed steel sheet.
 - 1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. 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 at the following locations:
 - 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 with long leg track and head of wall movement connectors; minimum track length of 12 feet.
 - 3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated, Drilled expansion bolts, and Screws with sleeves.
- C. Welding: Comply with AWS D1.1/D1.1M.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing components are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with ASTM C1007 requirements and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches on center, maximum; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at 16 inches on center; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.
- D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged galvanized surfaces with primer.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.

B. Maximum Variation of any Member from Plane: 1/4 inch.

END OF SECTION

**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 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; 2023.
- 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; 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- 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; 2018a.
- I. 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; 2019, with Editorial Revision (2020).
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- 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 C 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. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.
- C. Lintels: As detailed; prime paint finish.
- D. 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, abrasions and 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 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; 2023.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- 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. Ceiling 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 2500
WEATHER BARRIERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and joints at base of wall.
- B. Membrane Through Wall Flashings: Self-adhered membrane flashings that comprise part of the air barrier system, intended by the air barrier manufacturer for use in masonry veneer wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Coordination of through wall flashing and masonry ties.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- C. Section 07 9200 - Joint Sealants: Sealing building expansion joints.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.04 REFERENCE STANDARDS

- A. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2017.
- C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2017.
- D. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- H. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 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.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Architect, General Contractor, Manufacturer's Representative and Applicator. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals.
 - 2. Review of surface preparation, minimum curing period and installation procedures.
 - 3. Review of special details and flashings.
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 - 5. Review of mock-up requirements.
 - 6. Review of inspection, testing, protection and repair procedures.
- B. Coordination of trades
 - 1. The Architect, General Contractor and Applicator shall evaluate adjacent materials such as windows, doors, etc. for conformance to project details. Adjacent trades shall provide scaled shop drawings for review by the Architect.
 - 2. The General Contractor shall make provision for installation of air seals between the primary air barrier and other wall components (penetrations, etc.) in order to maintain continuity of an air barrier system.
 - 3. The Applicator shall provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
- E. Air/water-resistive barrier membrane manufacturer shall provide an ICC-ES Evaluation Report confirming compliance with AC212 Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers over Exterior Sheathing or Masonry or ICF.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

1.07 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Evaluated Materials Program; www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer. Air barrier Subcontractor(s) shall be accredited minimum of three years at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA).
- C. Components used in this section shall be sourced from one manufacturer, including membrane, air barrier sealants, primers, mastics, self-adhered flashings and adhesives as listed and approved as an evaluated air barrier assembly by the Air Barrier Association of America.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- B. All pail goods shall bear the ABAA Evaluated Air Barrier label
- C. Store roll materials on end in original packaging.
- D. Keep all products stored at above 40°F. Apply to a substrate with a surface T°F of 40°F and rising. DO NOT ALLOW PRODUCT TO FREEZE.
- E. Protect rolls from direct sunlight until ready for use.
- F. Do not double stack pail goods.

1.09 MOCK-UP

- A. Mockups: Before beginning installation of air/water-resistive barrier, provide air/water-resistive barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, roof tie-in and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air/water-resistive barrier before external insulation and cladding is installed.
 - 2. If Architect determines mockups do not comply with project requirements, reconstruct mockups and apply air/water-resistive barrier until mockups are approved.
 - 3. Contractor shall provide an in-place mockup of each type of expansion joint transitions between air barrier and roofing systems, and at angle changes, prior to proceeding with this work. Failure to provide mockup for review and approval will result in required removal of cladding as required to allow observation by A/E.
- B. Install air barrier materials in mock-up specified in Section 04 2000.
- C. Provide air/water leakage testing for air barrier materials and flashings located at mockup window systems per Division 8 Sections.

1.10 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.11 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturers 10 year material warranty.
 - 1. Ensure all manufacturers installation guidelines, specifications, details and warranty requirements are met.
 - 2. Warranty period shall be 10 years from date of substantial completion.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. General: Air/water-resistive barrier shall be capable of 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. At wall cladding transitions, the air/water-resistive barrier shall form a continuous air barrier and shall make provision for water drainage, either by creation of an unobstructed drainage plane that extends across the cladding transition or by flashing to discharge to the exterior at the transition. Air barrier assemblies shall be capable of accommodating substrate movement and sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits, or interruption of the drainage plane.
- B. Air Barrier shall be compatible with glass-mat faced gypsum, and masonry wall systems.

- C. The weather barrier assembly, including but not limited to, fluid applied air/water-resistive barrier membrane, sheathing fabric, transition membrane and flashing primer shall be obtained or approved as a single-source from the membrane manufacturer to ensure system compatibility and integrity.
- D. Air Barrier:
 - 1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating on wall surface and related thru-wall flashings, flashings for rough openings, windows, doors, base flashings and terminations to the roof.
 - 2. On outside surface of sheathing of exterior walls use air barrier coating on wall surface and related thru-wall flashings, flashings for rough openings, windows, doors, base flashings and terminations to the roof.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier, Fluid Applied: Vapor permeable waterproofing.
 - 1. Air Barrier Coating:
 - a. Assembly Performance: Provide a continuous air barrier in the form of an assembly tested in accordance with ASTM E2357
 - b. Dry Film Thickness (DFT): Shall be minimum thickness as specified in the manufacturer written instructions for the substrate being applied and to produce a smooth pinhole-free surface and as required to achieve warranty.
 - c. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
 - d. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
 - e. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to six months of weather exposure after application.
 - f. Tensile bond: Minimum 15 psi or exceeds strength of substrate when tested in accordance with ASTM C297/C297M.
 - g. Pull Adhesion: Minimum 110kPa (16psi) or substrate failure in accordance with ASTM D4541 for the substrate being applied.
 - h. Multi-Story Wall Assembly Burn Test: For multi-story buildings where required by code, Air Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.
 - i. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - j. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - k. VOC Content: 50 g per L or less.
 - l. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
 - m. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - n. Manufactures and Products:
 - 1) Acrylic, Water-Based:
 - (a) Barritech VP by Carlisle Coatings and Waterproofing, Inc: www.carlisleccw.com
 - (b) Air-Bloc 33MR, 17MR by Henry Company: www.henry.com
 - (c) Wall Guardian by STS Coatings, Inc.: www.stscoatings.com
 - (d) ExoAir 230 by Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com
 - 2) STP/STPE Based:
 - (a) Air-Bloc All Weather STPE, 33MR, 17MR by Henry Company: www.henry.com
 - (b) DensDefy by Georgia-Pacific: www.buildgp.com
 - 3) Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Sealants, Flashings, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Self-adhered Membrane Through Wall Flashing:
 - 1. Provide air barrier manufacturer's flexible, self-sealing through-wall flashing with silicone release sheet and associated accessories for:
 - a. Flashing at spandrels and cavities; under copings, band courses, and sill
 - b. Over lintels and shelf angles
 - c. At low roof to high wall conditions and all other wall conditions necessary to provide a watertight wall assembly.
 - 2. Manufacturers: Flashings shall be provided by the air barrier manufacturer, or explicitly approved in writing by the air barrier manufacturer for use as part of their warranted air barrier system.
 - 3. Accessories:
 - a. Provide manufacturer's surface conditioner and primer.
 - b. Termination Mastic:
 - 1) Description: Manufacturer's approved 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.
 - e. Refer to Section 07 6200 for metal through wall flashing drip edges and flashings.
- C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
- D. Transition Membrane, Seam and Window Flashing and High Temperature Rated Membrane: Peel and stick flashing membrane film bonded to sealant.
 - 1. Thickness: 25 mil, 0.025 inch minimum.
 - 2. Roll Width: 4, 6, 8 inch, as required for application.
 - 3. Coordinate installation with the Masonry Contractor and other provisions as required in Section 04 2000 - Unit Masonry.
- E. Thinners and Cleaners: As recommended by material manufacturer.
- F. Backer Rod: ASTM C 1330, Type B (bicellular material with a surface skin).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.
- B. Walls
 - 1. Substrates
 - a. Wall sheathing must be securely fastened per applicable building code and sheathing manufacturer's requirements.
 - b. Examine surfaces to receive air/water resistive barrier and verify that substrate and adjacent materials are dry, clean, sound, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than 1/4" in 10'. Verify that no excess mortar exists on masonry ties, shelf angles and other obstructions.
 - c. Verify that concrete is visibly dry and free of moisture.
 - d. Verify that masonry joints are struck flush and completely filled with mortar.
 - 2. Flashings
 - a. All flashings must be installed in accordance with specific design and building code requirements. Where appropriate, end-dams must be provided.

- b. Openings must be flashed prior to window/door, HVAC, etc. installation. Windows and openings shall be flashed according to design and building code requirements.
 - c. Individual windows that are ganged to make multiple units require continuous head flashing and the joints between the units must be fully sealed.
- 3. Kick-out flashing
 - a. Kick-out flashing must be installed leak-proof and angled (min 100°) to allow for proper drainage and water diversion.
- 4. Air Seals
 - a. Install between the primary air/weather barrier and other wall components (penetrations, etc.) in order to maintain continuity of the air barrier system
- C. Report all unsatisfactory conditions to the General Contractor. Application of fluid-applied air/water-resistive barrier shall not proceed until all unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Prepare in a container that is clean and free of foreign substances. Do not use a container which has contained or been cleaned with a petroleum-based product. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.
- B. Sheathing joints or joints in ICF less than 1/2" shall be treated with liquid flashing as recommended by the manufacturer.
- C. Sheathing joints or joints in ICF over 1/2" shall be treated with transition material or as recommended by the manufacturer.
- D. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- E. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Apply additional membrane and/or sealant at all masonry wall ties and zee subframing fastened through air barrier for claddings.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Coatings:
 - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
 - 2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
 - 3. Use flashing to seal to adjacent construction and to bridge joints.
- E. Membrane Through Wall Flashings at Masonry:
 - 1. General:
 - a. Whether or not specifically indicated, install membrane flashings to divert water to exterior at all locations where downward flow of water will be interrupted.
 - b. Install metal through wall flashing in accordance with Section 07 6200. Metal flashing shall be continuous including at elevation changes (i.e. steps).
 - 2. Mockup:

- a. 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.
 - b. Failure to provide mockup or review of through wall flashing materials prior to installation of insulation and masonry may result in removal and reinstallation of materials at Contractor's expense, as required to observe installed conditions at flashings.
 - c. 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 at no cost to the Owner.
3. Preparation:
 - a. Install flashing to dry surfaces when air and surface temperatures are 40°F and above.
 - b. All flashings shall be installed to produce a fully watertight assembly.
 - c. 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.
 - d. Precut pieces of flashing to easily handled lengths for each location.
4. Installation:
 - a. Remove release paper and position flashing carefully before placing it against the surface.
 - b. 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.
 - c. Overlap adjacent pieces 6" and roll all seams with a steel hand roller.
 - d. Install prefabricated external and internal corners and end dams.
 - e. Extend the flashing from 1/2" inside the face of the exterior wall, through the exterior masonry wythe, and up the cavity space a minimum of 6" above the top of the cavity drainage system. Install termination bar at top of flashing and seal with mastic. Strip in air barrier over through wall flashing.
 - f. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts, and penetrations for a completely watertight condition.
 - g. Membrane flashing shall not be permanently exposed to sunlight.
5. Transitions:
 - a. At all flashing terminations to openings, expansion joints, and changes in height, provide metal and membrane formed end dams with all seams sealed watertight.
 - b. Provide compressible filler at the end of all flashings at steel lintels.
6. Protection:
 - a. Do not expose flashing membrane to sunlight for more than thirty (30) days prior to enclosure.
 - b. Do not allow the surface of the flashing membrane to come in contact with incompatible materials, including but not limited to polysulfide sealants, creosote, uncured coal tar products or EPDM.
- F. Openings and Penetrations in Exterior Weather Barriers:
 1. Install flashing extending a minimum 3 inches onto vertical wall and into rough opening with transition membrane.
 2. Hollow Metal Door Frames: Seal door frame to wall surface with transition membrane.
 3. Perimeter wood nailers at wall openings: Cover all exposed surfaces of wood nailers with transition membrane. Extend membrane over ICF, sheathing, masonry and metal framing.
 4. Aluminum frames: Seal frames to the wall surface with transition membrane.

5. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
 6. Cladding Attachment Penetrations: provide application of butyl tape to the base of all masonry ties and subgirts installed with fasteners through weather barrier.
- G. Expansion Joints in Exterior Weather Barriers:
1. Expansion joints are required at all structural expansion joints and along slip tracks in metal stud framing systems at walls. Provide manufacturer's recommended detailing at other locations with potential movement, including control joints in concrete masonry wall systems.
 2. Coordinate installation of new infill wall materials after removal of any existing cladding materials, to ensure that expansion joint at weather barrier plane is in line with expansion joint at exterior cladding.
 3. Install weather barrier materials at new infill wall, provide sealed termination bar secured at 6" o.c., extending a minimum of 4 inches onto the existing backup wall and weather barrier system. Ensure that all terminations of new weather barrier at existing is air- and water-tight.
 4. Install insulation and fire rated materials at gap as indicated in the Drawings or required for wall construction.
 5. Provide transition membrane and backer rod at gap as indicated in the Drawings, fully stripped in with fluid applied weather barrier system in full accordance with manufacturer details and requirements.
 6. Expansion joints at air barrier system shall be sealed air and watertight to expansion joint materials in roofing systems, with compatible materials.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Do not cover installed weather barriers until required inspections have been completed. Contractor is responsible for coordinating all inspections with Architect and/or Owner.
- C. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- D. Take digital photographs of each portion of the installation prior to covering up.
- E. Weather Barrier Protection and Failure Protocol:
 1. Contractor failure to provide the protection specified will result in the following, at no cost to the Owner:
 - a. Replacement of all failed materials in full accordance with manufacturer requirements, to dry substrates. Failure is defined as inadequate adhesion, chemical deterioration, or blisters (entrapped air). After replacement the Contractor shall provide the above specified protection until completion of roofing materials.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART I - GENERAL

1.01 WORK INCLUDED

- A. Install flashing and sheet metal as indicated on Drawings and in these specifications as required for a complete and proper installation. The following items are included:
 - 1. Edge metal and fascia metal.
 - 2. Sheet metal counterflashing.
 - 3. Sheet metal counterflashing.
 - 4. Square to round sheet metal flashing for vent stacks.
 - 5. Expansion joint covers and area divider covers.
 - 6. Sheet metal embedded wall flashings and through wall flashings.

1.02 RELATED WORK

- A. Section 06 1000 - Rough Carpentry
- B. Section 07 7200 - Roof Accessories

1.03 REFERENCE STANDARDS

- A. ANSI/SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 3000.
- B. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.
- C. Submit samples under provisions of Section 01 3000.
- D. Sealant product data and color chart(s).

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA and NRCA standard details and requirement.

1.06 QUALIFICATIONS

- A. Company specializing in sheet metal flashing work with a minimum of 10-years documented experience.

1.07 STORAGE AND HANDLING

- A. Stack pre-formed materials to prevent twisting, bending, or abrasion, and to provide ventilation.
- B. Prevent contact with materials during storage that may cause discoloration, staining, or damage. Materials damaged by improper storage techniques, including "white rust" will be rejected and replaced at Contractor's expense.

1.08 WARRANTY

- A. Sheet Metal work and accessories to be included in Two-Year Contractor's Warranty.
- B. Provide pre-finished metal manufacturer's 20-year finish guarantee.
- C. Provide pre-finished metal manufacturer's 20-year galvanized steel guarantee.

PART 2 - PRODUCTS

2.01 SHEET METALS

- A. Sheet metal flashing: 24 gauge galvanized steel. Refer to Section 07 5419 for membrane coated 24 gauge galvanized steel.

- B. Pre-finished metal: 24 gauge galvanized steel, Kynar 500 finish. Color selection available from standard and premium colors.
- C. Galvanized metal: 20 and 22 gauge galvanized steel, minimum G-90 coating thickness per ASTM A 653.
- D. Stainless steel metal: 24 gauge, Type 304, 2b Finish, ASTM A240.

2.02 SHEET METAL COMPONENTS

- A. Receivers and Counterflashing:
 - 1. Curbs: 24-gauge stainless steel and/or galvanized steel, or as noted in the Drawings.
 - 2. Walls: 24-gauge prefinished galvanized steel or as noted in the Drawings.
- B. Copings, Edge flashing, Expansion Joint Covers, Gutters, Scupper Trim, Conductor Heads and Downspouts: Pre-finished 24 gauge galvanized steel.
- C. Two-piece fascia extension profile is required whenever fascia vertical height exceeds 8 inches or as required to meet ANSI/SPRI ES-1. Multiple piece fascia conditions will be equally sized and installed.
- D. Cover Plates, End Caps and Miscellaneous Sheet Metal: Same materials, gauge and profile as edge metal or expansion joint material.
- E. Cleats: Minimum 20 gauge galvanized steel or as noted in the Drawings.
- F. Hoods for Pipe Penetration Curbs: 24 gauge galvanized steel.
- G. Square to Round Flashings: Minimum 24 gauge stainless steel.
- H. Embedded Wall Flashings:
 - 1. Flashing at Openings:
 - a. 20 gauge stainless steel, size and configuration as indicated in the Drawings.
 - b. Provide shop fabricated corners at head and jamb intersections with all joints soldered. Provide double bead continuous sealant at all other joints.
 - 2. Drip Edge Flashings at Openings:
 - a. Head, jamb, and sill flashing extension: 24 gauge prefinished galvanized steel or .050" prefinished aluminum, as required to match adjacent finishes.
 - b. Sill flashings at storefront/curtainwall: 24 gauge stainless steel, with fully sealed end dams.
 - c. All joints lapped and sealed.
 - 3. Through Wall Flashings with Drip Edge: Minimum 24 gauge stainless steel.

2.03 ACCESSORIES

- A. Solder: ANSI/ASTM B 32 50/50 type.
- B. Blind Pop-Rivets: Stainless steel, with stainless steel mandrels. Exposed pop-rivets shall be pre-finished to match the color of sheet metal.
- C. Clamping Collar: Stainless steel of size necessary to fit over vent or pipe circumference, as applicable.
- D. Umbrella flashing: 26 gauge stainless steel, premanufactured soldered flashing, Umbrella Bell Cap Model UMB-BELL as manufactured by SBC Industries.
- E. Self-Adhered/Underlayment Membrane: High-temperature, high strength membrane composed of asphalt or butyl rubber adhesive with a top layer of laminated polyethylene, 30 – 60 mils, ASTM D1970. Membrane shall be approved by the manufacturer for the intended application.
- F. Liquid Membrane: Two component, elastomeric, cold applied liquid membrane compatible with self-adhered membrane.
- G. Aluminum Foil Tape: 3M aluminum foil tape 425, or as required by the manufacturer.

- H. Sealant Tapes: Polyisobutylene butyl elastic tape, minimum 1/8-inch thickness and 3/4-inch width.
- I. Batt Insulation: for use at expansion joint retainer flashings, fiberglass batt insulation, unfaced, ASTM C665.
- J. Paint System:
 - 1. Primer: Kem Kromik Universal Metal Primer or approved equivalent.
 - 2. Paint/Coating: Sherwin-Williams Sher-Cryl HPA or approved equivalent.
 - 3. Color: to match existing.

2.04 SEALANT

- A. Type I: Application exposures to sunlight, ASTM C-920-87, Federal Specification TT-S-00230-C one component gun-grade polyurethane sealant suitable for continuous immersion and resistant to asphalt products.
- B. Type II: Applications not exposed to sunlight, butyl rubber based.
- C. Hot vent sealant: A one component neutral moisture curing silicone sealant.
- D. Primer: As required by sealant manufacturer.
- E. Colors: Sealants to match color of metal or substrate.

2.05 SCHEDULE OF FASTENERS

- A. Exposed fasteners: Shall be stainless steel with stainless steel bonded neoprene or EPDM washers. Exposed fastener heads shall be pre-finished to match the color of sheet metal.
- B. Fasteners shall be compatible to all materials to which they come in contact.
- C. Cleat, Counter-flashing, and Surface Fastened Components.
 - 1. Wood Substrate: No. 10 stainless steel wood screws with stainless steel bonded neoprene washers of length necessary to penetrate wood substrate one inch.
 - 2. Metal Substrate: Minimum No. 10 stainless steel sheet metal screws or as necessary to suit application with stainless steel bonded neoprene washers.
 - 3. Concrete or Masonry Substrate:
 - a. Flashings: 3/16" diameter, stainless steel Tapcon Concrete/Masonry Anchors or approved equivalent, length sufficient to provide 1" min. embedment into substrate.

2.06 FABRICATION

- A. Form sections to match existing profiles, true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate continuous cleats and starter strips of same material as sheet, inter-lockable with sheet.
- C. Fabricate expansion joint covers and coping with 1-inch standing seams.
- D. Form pieces in longest practical lengths.
- E. Hem exposed edges of metal 1/2-inch; miter and seam corners.
- F. Form materials with cover plate seam.
- G. Fasten and seal metal joints.
- H. Fabricate corners from one piece with minimum 18-inch and maximum 36-inch long legs; fasten for rigidity, seal with sealant.
- I. Fabricate vertical faces with bottom edge formed outward 1/4-inch and hemmed to form drip.
- J. Form edge metal/fascia as existing profiles as specified herein and as shown on Drawings.
- K. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

- L. Enlarge holes for fastening counter flashing, coping, and pressure bars as necessary to allow for thermal expansion and contraction. Cover exposed holes with appropriate washers.
- M. All fabrication, installation, terminations, and transitions of sheet metal shall be in accordance with the latest published SMACNA and NRCA guidelines and recognized roofing and sheet metal industry standards.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.
- C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Apply protective membrane backing on surfaces in contact with dissimilar materials, including between existing steel decks and treated wood.
- C. Tie-ins or contact with dissimilar metals: Install separation layer of elastomeric membrane between metal surfaces.

3.03 INSTALLATION - GENERAL

- A. Provide flashings of materials indicated on Drawings at all junctures of the roof with perimeters, curbs, mechanical, electrical equipment, etc., that a completely watertight installation is achieved.
- B. Fabricate and install sheet metal work with lines, arises and angles sharp and true, and plane surfaces free from warps and buckles. Bead or return all exposed edges.
- C. Soldering: Tin metal for full area of contact on soldered seams and joints. Do soldering slowly with well heated coppers and stainless steel metals, thoroughly heating seams and completely filling them with solder.
- D. Prime all sheet metal to receive roofing in accordance with manufacturer's requirements.
- E. Apply bed of water cutoff mastic directly below sheet metal that is set over roofing membrane or in other areas as required by the Drawings, and the manufacturer's specifications.
- F. Submit details not covered in Drawings for approval by Owner or A/E.
- G. Install starter and edge strips, and cleats before starting installation.
- H. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by A/E.
- I. Lock and seal all joints.
- J. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- K. Fasten sheet metal with approved fasteners at a minimum of 12 inches on centers unless otherwise specified in these Specifications or the Drawings.
- L. Install back-up and cover plates in accordance with SMACNA and as described in the Construction Documents.

3.04 COPING AND EXPANSION JOINT INSTALLATION

- A. Coordinate installation of roofing materials at copings and expansion joint conditions to ensure a continuous air seal, installed at air barrier system at walls and continuous through roof conditions as detailed in the Drawings.

1. Notify A/E when continuous air seal assembly is ready for review at roof to wall transitions prior to proceeding with installation of roof flashings that would conceal this condition.
- B. Fabricate and install these flashings according to the Drawings, latest published SMACNA and NRCA guidelines, and in accordance with recognized roofing and sheet metal industry standards.
- C. All horizontal joints shall have a 1" standing seam as shown in the Drawings.
- D. Vertical flanges shall have a minimum height of three (3) inches. High side (outside) shall be cleated continuously; other side mechanically fastened as shown on the drawings.
- E. All corners shall be shop mitered, and all shall not be more than two feet beyond a corner in either direction.
- F. Provide a minimum slope of 1" per foot at copings and 2" per foot at expansion joint flashings.

3.05 TWO-PIECE COUNTERFLASHING INSTALLATION

- A. Secure counterflashing receiver over base flashing to substrate with appropriate fasteners. Secure counterflashing to receiver with stainless steel screws with bonded neoprene washers spaced 12-inches on centers.
- B. Pop-rievet and solder all seams of galvanized or stainless steel two-piece counterflashings, pop rivet and seal seams of prefinished galvanized steel.

3.06 METAL EDGE FLASHING INSTALLATION

- A. Install edge flashing in a uniform application of compatible sealant over roof membrane.
- B. Apply sealant, Type I, under cover plates at all joints prior to installation.
- C. Fasten horizontal flange in a staggered pattern on three-inch centers.
- D. Strip-in edge flashing as specified in membrane roofing sections.
- E. Install compatible sealant along finished edge of stripped in membrane at all metal edge flashings.

3.07 CLEAT INSTALLATION

- A. Install cleats for edge/coping flashing with appropriate fasteners on six-inch centers.

3.08 PIPE PENETRATION FLASHINGS

- A. Pipe penetrations for electrical, refrigerant, and gas lines shall be through raised wood curbs with a minimum height of 12" above the plane of the finished roof, in accordance with Drawings.
- B. Vent pipe penetrations shall be flashed with manufacturer's pre-formed pipe flashing, secured with a stainless steel clamping ring, with sealant inside the flashing behind the ring and on top of the ring.
 1. An additional 24 gauge galvanized steel umbrella flashing shall be installed as specified in the Drawings to cover the top of the preformed flashing by three (3) inches.
 2. Umbrella flashing shall be secured with a second clamping ring and silicone sealant applied to the top edges.

3.09 EMBEDDED WALL FLASHING INSTALLATION

- A. General: set all embedded wall flashings in a continuous bead of sealant against wall substrates prior to securing flashings in place.
- B. Flashings at head, jamb, and sill conditions:
 1. Verify that air barrier membrane detailing at opening is complete at all surfaces to receive flashings. Refer to the Drawings and Section 07 2500, "Weather Barriers".
 2. Install flashings as indicated in the Drawings at head, jamb and sill conditions. Provide full bed of sealant between all flashings and substrate to receive flashing. Minimum lap width 6".

3. Fasten flashings at 16" o.c. maximum, ensuring fasteners engage framing components for proper and snug attachment. Ensure that fastener heads are flat and installed flush with flashing metal.
 4. Provide two beads of continuous sealant at all laps in flashings at head, jamb, and sill conditions. Seat metal pieces such that full embedment in sealant is achieved at laps. Minimum lap width 6". Provide rivets as required to hold flashing components in place until sealant cure.
 5. Provide shop fabricated, soldered corners and install at intersections of head, jamb and sill flashings. Set corners in full bed of sealant. Rivet edges of corners to adjacent flashings as required to maintain full contact of sheet metals at lap until full sealant cure.
 6. Attach metal flashings and corners to substrate as required to secure to substrate with no protruding edges. Ensure installed condition is acceptable to air barrier manufacturer for strip in installation.
- C. Drip edge flashings at openings:
1. Verify that air barrier membrane detailing is complete at all surfaces to receive flashings. Refer to the Drawings and Section 07 2500, "Weather Barriers".
 2. Install flashings as indicated in the Drawings.
 - a. Sill Flashings: Ensure that end dams sit snug against jamb substrate with air barrier flashings in place, with a full bed of sealant present. Seal top edge of end dam to air barrier flashing surface. Where prefinished sill extension is present, install after completion of cladding materials. Secure to drip edge and continuous cleat at cladding surface.
 - b. Drip flashings at head conditions: Ensure that prefinished surface of flashing faces exterior. Do not install drip flashing in a manner that interferes with perimeter window sealant bond to air barrier flashings at opening.
 3. Fasten flashings at 16" o.c. maximum, ensuring fasteners engage framing components for proper and snug attachment. Ensure that fastener heads are flat and installed flush with flashing metal.
 4. Provide two beads of continuous sealant at all laps in flashings. Seat metal pieces such that full embedment in sealant is achieved at laps. Provide rivets as required to hold flashing components in place until sealant cure. Minimum lap width 6".
 5. Attach metal flashings and corners to substrate as required to secure to substrate with no protruding edges. Ensure installed condition is acceptable to air barrier manufacturer for strip in installation.

3.10 THROUGH WALL FLASHING INSTALLATION

- A. Fabricate stainless steel through wall flashing based on field verification as indicated in the drawings, with horizontal leg extending 1/2" maximum beyond masonry surface.
- B. Clean and prime substrates to receive flashing, and install flashing in a full bed of sealant.
1. Fasten flashings to backup walls at 16" o.c. maximum and to masonry or concrete walls at 12" o.c. maximum with flat head stainless steel screws.
 2. Provide a minimum lap of 6" between sections. Provide continuous double beads of sealant at laps and secure with rivets.
 3. Fully solder or seal all joints at end dams and transitions.
 4. Provide end dams at all terminations to openings, transitions in height, and expansion joint conditions.
- C. Install through wall flashing membrane in accordance with Section 07 2500.

3.11 CLEANING

- A. Remove markings from all exposed sheet metal.

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 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Installation of rooftop supports at all pipe/conduit, duct, and non-curbed roof mounted equipment.
 - 2. Installation of non-penetrating equipment platforms.
 - 3. Furnishing and installing roof hatch, hatch safety rails, ladder access pole and wall mounted ladders at roof hatch and at exterior wall between roofs.

1.03 SUBMITTALS

- A. Pre-Installation Submittals:
 - 1. Product Data: Submit for all products proposed for use, describing physical characteristics and method of installation.
 - 2. Shop Drawings:
 - a. Dimensioned Shop Drawings: Before beginning fabrication of equipment submit scaled shop drawings showing layout, profiles, and product components, including anchorage, accessories and finish, along with general arrangement of the equipment and their working positions.
- B. Closeout Submittals:
 - 1. Provide applicable manufacturer's warranties prior to the contract closeout.
 - 2. As-built shop drawings noting changes made during installation.
 - 3. Maintenance information.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed specified system installations similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of specified roof accessory products, with not less than ten years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials in accordance with manufacturer's printed instructions. Deliver materials in manufacturer's original wrappers, dry, and undamaged with seals and labels intact.
- B. Damaged materials (moisture, fire, or other) resulting from noncompliant storage practices shall be removed and replaced at Contractor's expense.

1.06 WARRANTY

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPORTS, AND PLATFORMS

- A. Manufacturer:
 - 1. Acceptable Manufacturer: PHP Systems/Design i.e. Portable Pipe Hangers; 5534 Harvey Wilson Drive, Houston, Texas 77020. ASD. Tel: (800) 797-6585. Fax: (713) 672-1170. www.phpsd.com. Email:info@phpsd.com.
 - 2. Pre-bid approved equivalent.
- B. APPLICATIONS
 - 1. Support pipes, conduit, cable trays, and ducting, a minimum of 8 inches (203 mm) above roof surface.
 - 2. Support Spacing: 10 feet MAXIMUM.
 - 3. For Electrical and Gas Lines 3-1/2 inches (89 mm) in diameter or less, up to 16 inches (406 mm) above roof; Portable Pipe Hanger Model number PP10.
 - 4. For Gas Lines 4 to 6 inches (100-150 mm) in diameter, up to 12 inches (305 mm) above roof; Portable Pipe Hanger Model number RB18.
 - 5. For single Electrical and Gas Lines 3 to 8 inches (80-200 mm) in diameter; Portable Pipe Hanger Model number PS 1-2.
 - 6. For Multiple Lines: Portable Pipe Hanger Model number PSE custom.
 - 7. Accessories for PSE Custom and Other Applications when required.
 - a. Un-insulated Piping: Roller support or clevis hanger.
 - b. Insulated Piping: Band hanger supported from horizontal channel or clevis hanger with Insulation Protection Shield.
 - c. Conduit: Band hanger supported from horizontal channel.
 - d. Bracing required when using base with swivel; when pipe exceeds 24 inches (610 mm) above roof, or when thermal expansion of pipe is great.
 - 8. Equipment Platforms shall consist of Portable Pipe Hanger Model PHP Equipment Platforms.
 - 9. Equipment supports shall consist of Portable Pipe Hanger Model number RTU-20.
 - a. Support Spacing: Install supports at locations indicated on the Drawings.
- C. Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations, or flashings, and without causing damage to the roofing membrane.
 - 1. Design system using high density, high impact polypropylene bases with carbon black, anti-oxidants for UV protection, and G-90 galvanized steel framing of 1-5/8 inch (41 mm) B22TH or 1-7/8 inch (48 mm) BTS22TH for support.
 - 2. Custom design system to fit piping, conduits, equipment to be installed and actual conditions of service and loading.
 - a. Piping Supports: Provide suitable hangers and supports.
 - b. Equipment Supports: Factory fabricated to support exact duct sizes and equipment to be installed.
- D. Bases: Injection molded high density, high impact polypropylene with UV-inhibitors and anti-oxidants, conforming to the following:
 - 1. Moisture Content: Negligible.
 - 2. Shrinkage/Swelling Due to Moisture: Negligible.
 - 3. Density: 55.8 lb/cu ft (894 kg/cu m).
 - 4. Insect Resistance: No known insect damage potential.
 - 5. Chemical Resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, and sulfuric acid) No visual or physical change apparent.
 - 6. Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D 1929.
 - 7. Sized as required by loading conditions and as indicated on the drawings.

8. Shop fabricated with inserts for square tubing or threaded rods as required.
 9. Color: Integral black color as molded.
 10. Bases for Mechanical Attachment: Sealant chamber around penetration point, with injection port for sealing after fastening; beveled lip for sealant bead around entire diameter.
 11. Do not use bases containing carbonated plastics, press molded recycled rubber and plastics, steel, stainless steel, or any injection molded threaded receivers.
- E. Pipe Supports and Hangers: Conform to MSS SP-58 and MSS SP-69 and as follows:
1. Fabricated of G-90 galvanized steel where framing is carbon steel; fabricated of stainless steel where framing is stainless steel; finished same as framing.
 2. Sizes 2-1/2 inch (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
 3. Sizes 3 inch (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.
- F. Stainless Steel Framing:
1. Channel Types: 1-5/8 inch (41.3 mm) or 1-7/8 inch (47.6 mm), as required for loading conditions.
 2. Thickness: 12 gauge (2.7 mm).
 3. Form: Roll-formed 3-sided or tubular channel.
 4. Finish: Mill finish.
 5. Do not use tubing or tube steel.
- G. Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.
1. Stainless Steel: Mill finish.
 2. Welded Steel Grating:
 - a. Metal Bar Grating Standards: Comply with NAAMM MBG 531 "Metal Bar Grating Manual".
 - b. Bearing Bar Spacing: 15/16 inch (24 mm) o.c.
 - c. Bearing Bar Depth: As required to comply with structural performance requirements.
 - d. Bearing Bar Thickness: As required to comply with structural performance requirements.
 - e. Crossbar Spacing: 4 inches (102 mm) o.c.
 - f. Grating Mark: as indicated.
 - g. Traffic Surface: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy resin adhesive.
 - h. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.
 3. Ballast:
 - a. Hanover Architectural Products, Standard Walkway and Ballast Paver, or equivalent concrete paver with a minimum weight of 23 psf.
 4. Provide one (1) paver on each side of condensing unit secured to welded steel grating, for a total of two (2) pavers. Provide stainless steel straps to secure pavers to grating.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Ensure that surfaces and site conditions are ready to receive Work and are acceptable to membrane manufacturer for required warranty.

3.02 INSTALLATION – EQUIPMENT SUPPORTS, AND PLATFORMS

- A. Install in accordance with manufacturer's instructions.
- B. Clean surfaces of roof in areas to receive portable support bases.

- C. Remove dirt, dust, oils, and other foreign materials.
- D. Use care in handling portable support system components during installation, to avoid damage to roofing, flashing, equipment, or related materials.
- E. Pipe, Cable, and Equipment Support Systems
 - 1. Locate bases and support framing as indicated on drawings and as specified herein. Provide complete and adequate support of all piping, ducting, and conduit, whether or not all required devices are shown.
 - 2. The use of wood for supporting piping is not permitted.
 - 3. Provide support spacing so deflection of piping does not exceed 1/240 of span.
 - 4. Install framing at spacing indicated, but in no case at greater than 10 feet (3 m) on center.
 - a. Accurately locate and align bases.
 - b. Consult manufacturer of existing or new roofing system as to the type of protection pads required between the roof and base.
 - c. Adhere bases to protection pads.
 - 5. Set framing posts into bases and assemble framing structure as indicated.
- F. Equipment Supports:
 - 1. Locate bases and support framing as indicated on Drawings and as specified herein. Provide complete and adequate support of all structures.
 - 2. Accurately locate and align bases.
 - a. Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and base.
 - b. Adhere bases to roof membrane manufacturer approved protection pads in accordance with roof membrane manufacturer's installation requirements.
 - 3. Set legs of substructures into bases as indicated.
 - 4. Secure equipment and ballast to welded steel grating with stainless steel fasteners. Provide additional framing secured to platform for electrical disconnect boxes.
- G. When requested by the Architect, provide a factory-trained representative of the manufacturer to visit the site while the work is in progress to assure that the installation conforms to the manufacturers design and installation requirements.

3.03 CLEANING AND PROTECTION

- A. Remove all packaging, unused fasteners, adhesive and other installation materials from the project site.
- B. Remove adhesive from exposed surfaces of supports and bases and leave the work area in clean condition.
- C. Provide protection as required, leaving the work area in undamaged condition at the time of completion of work.

END OF SECTION

**SECTION 07 9200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. 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 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
- I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).
- J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- K. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

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 NONSAG JOINT SEALANTS

- A. Type EJS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 4. Color: Match adjacent finished surfaces.
 5. Service Temperature Range: Minus 20 to 180 degrees F.
- B. Type EJS-1 - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: Match adjacent finished surfaces.
 4. Service Temperature Range: Minus 65 to 180 degrees F.
- C. Type IJS-2 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: Match adjacent finished surfaces.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- D. Type IJS-3 - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 2. Color: As scheduled.
 3. Service Temperature Range: Minus 40 to 180 degrees F.
- E. Type IJS-4 - Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finished surfaces.
 2. Service Temperature Range: Minus 40 to 180 degrees F.

- F. Type IJS-1 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
- G. Type EJS-2, EJS-3 - Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.04 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. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - 2. Color: Gray.
 - 3. 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. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - 2. Color: Gray.
 - 3. 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.

2.05 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 08 3323
OVERHEAD COILING DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior insulated coiling doors.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

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; 2023.
- C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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.

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. Overhead Door Corporation: www.overheaddoor.com
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

- A. Exterior 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/ft² 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 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. Manual hand chain lift operation.
 9. Mounting: Surface mounted.
 10. Locking Devices: Slide bolt on inside.

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. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.
 2. Manual Chain Lift: Provide padlockable chain keeper on guide.
- 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.

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. 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 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.
- C. Related Sections
 - 1. Section 05 2100 - Steel Joist Framing: Shop priming
 - 2. Section 05 5000 - Metal Fabrications: Shop priming
 - 3. Section 06 2000 - Finish Carpentry: Back priming of trim and paneling
 - 4. Division 23 - Mechanical Identification: Markers and color-coding
 - 5. Division 26 - Electrical Identification: Markers and color-coding

1.02 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.

1.03 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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.

1.08 MAINTENANCE

- A. Extra Materials
 1. At completion of project, deliver to Owner extra stock of materials used on project as follows:
 - a. 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. PPG Paints: www.ppgpaints.com
- D. Benjamin Moore & Co.: www.benjaminmoore.com.
- E. 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.

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.

2.05 INTERIOR DRYWALL TEXTURING

- A. Interior drywall texturing compounds shall be equal to USG Tuf-Tex Wall and Ceiling Texture. Unless shown or otherwise indicated on the drawings, provide "Heavy Orange Peel or Spatter Finish" texture on walls or ceilings, as directed by Architect. Do not knockdown or drag texture.
- B. Mix 1 Gallon of latex paint with each 50 lbs. of texture.

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.
 4. Allow applied coats to dry before next coat is applied.
- E. Apply coatings using methods recommended by manufacturer.
- F. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- 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. Sand surfaces lightly between coats to achieve required finish.
- J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- K. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- L. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- M. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- N. 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.
- O. At gymnasiums, contractor shall paint wood blocking for gym equipment supports to match adjacent color. Contractor shall coordinate the sequencing with all trades.
- P. 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.
- Q. Miscellaneous surfaces and procedures
 - 1. Refer to mechanical and electrical standards for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
 - 2. 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.
 - 3. 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.
 - 4. Hardware: Paint prime coated hardware to match adjacent surfaces.
 - 5. Wet areas
 - a. In toilet rooms and contiguous areas, add an approved fungicide to paints.
 - 6. Exposed vents: Apply two coats of heat-resistant paint approved by the Architect.
- R. Inspection: The coated surface must be inspected and approved by the architect just prior to each coat.
- S. Cleaning: Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

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.
- D. Preparation and Painting of Existing Vinyl-Covered Gyp Board Walls
 1. Remove all loose or delaminated vinyl and clean wall thoroughly.
 2. Fill joints with Caulk equal to Sherwin-Williams 1050 Quick Dry Siliconized Acrylic Latex Caulk.
 3. Float seam smooth with regular compound mud (no tape). Let dry.
 4. Float seam a second time with regular compound mud and fiberglass mesh tape. Let dry.
 5. Mix regular compound mud with Primer-Sealer. Roll on mix over the entire panel with ¾" nap roller. Let dry.
 6. Finish wall surface with primer coat and 2 finish coats as specified in Finish Code 110.

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. Interior Surfaces
 - 1. Ferrous Metal
 - a. Primer – S/W DTM Bonding Primer (B66A00050)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 2. Galvanized Metal
 - a. Primer – S/W DTM Bonding Primer (B66A00050)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 3. Wood – Painted
 - a. Primer – S/W Premium Wall and Wood Primer (B28W8111)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 4. Wood – Stain
 - a. Stain – S/W WoodClassic 250 Stains
 - b. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Gloss (A68 Series)
 - c. Or
 - d. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Satin (A68 Series)
 - 5. Gypsum Wallboard
 - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 6. Gypsum Wallboard – Kitchens
 - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 7. Concrete Masonry Units (CMU)
 - a. Primer – S/W Heavy Duty Block Filler (B42W46)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 8. Concrete Masonry Units (CMU) – Kitchens
 - a. Primer – S/W Heavy Duty Block Filler (B42W46)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 9. Concrete Floors
 - a. Primer – S/W ArmorSeal Floor Plex 7100 Primer (B70W / B70V)
 - b. Finish – S/W ArmorSeal 1K Waterbased Urethane Floor Enamel (B65-775 Series)
 - 10. Masonry/Concrete Ceilings
 - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-560 Series)
- B. Exterior Surfaces
 - 1. Ferrous Metal
 - a. Primer - S/W DTM Bonding Primer (B66A00050)
 - b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 2. Galvanized Metal

- a. Primer - S/W DTM Bonding Primer (B66A00050)
- b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
3. Wood
 - a. Primer – S/W A-100 Latex Wood Primer (B42W41)
 - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
4. Concrete and CMU
 - a. Primer – S/W Loxon XP Waterproofing Coating (A24-1400 Series)
 - b. Finish - S/W Loxon XP Waterproofing Coating (A24-1400 Series)
5. Fiber-Cement Material
 - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
 - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
6. Parking Lot Lines
 - a. SetFast Acrylic Latex Traffic Marking Paint (TM21 Series)
 - b. Colors
 - 1) YELLOW for Parking Stripes
 - 2) RED for Fire Lanes with WHITE Lettering
 - 3) WHITE for Band Practice Field striping
 - 4) BLUE and WHITE for Handicap Parking symbols
7. Mechanical Piping and Pumps
 - a. First Coat: One coat Devran 205 Universal Epoxy Primer.
 - b. Second Coat: Two coats Devthane 379UVA Aliphatic Urethane Gloss Enamel.
 - c. Preperation:
 - 1) Thoroughly clean surfaces receiving paint of dirt, grease, oil, rust and scale.
 - 2) Unless otherwise specified, paint using three coats of selected colors. Mix and use exactly as specified by the manufacturer. Allow each coat to dry thoroughly before applying succeeding coats. Painting shall not be sprayed due to proximity to cooling tower.
 - 3) Upon completion of painting, remove all scaffolds, surplus material, rags and trash to leave spaces neat and clean.
 - d. Color as selected by the Architect.

END OF SECTION

**SECTION 10 7300
PROTECTIVE COVERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-engineered, pre-finished extruded aluminum wall mounted hanging canopies.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete

1.03 REFERENCE STANDARDS

- A. AA ADM – Aluminum Design Manual; As Referenced in the International Building Code.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- C. AAMA 612 - Voluntary Specification, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2002.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performance Organic Coatings on Aluminum Extrusions and Panels - American Architectural Manufacturers Association; 2011
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 6000 Tensile Strength; 2010.
- F. ASTM A792/A792M - Steel Sheet, 55% Aluminum-Zinc Alloy Coated by Hot Dip Process; 2010.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2012.
- I. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs; 2002 (Reapproved 2008).

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 profession 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. Designer Qualification Statement.
- G. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.
- H. Installer Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform 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, and;
 - 1. With minimum five years of documented experience.
 - 2. Approved by manufacturer.
- D. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway or canopy system (sidewalks, curbs, building fascias, etc.).

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. 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 and two years for anodized finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Covers:
 - 1. AVAdek: www.avadek.com.
 - 2. Architectural Fabrication, Inc.: www.arch-fab.com.
 - 3. Aluminum Techniques Inc.: www.aluminumtechniques.com.
 - 4. Canopy Solutions, LLC: www.canopy-solutions.com.
 - 5. DITT-Deck, Dittmer: www.dittdeck.com.
 - 6. Peachtree Protective Covers: www.peachtreecovers.com.
 - 7. East Texas Canopy, Inc: www.easttexascanopy.com.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CANOPY SYSTEMS

- A. The Contractor's Canopy Engineer shall design the attachment of the canopies to the Structure. Where allowable reactions are provided on the Structural Drawings, the Contractor's Canopy Engineer shall design their attachments to not exceed these allowable reactions. Where no allowable reaction is provided, the Contractor's Canopy Engineer shall evaluate the Structure provided and limit reactions so as to not exceed its structural capacity or modify the existing structure in a way that is approved by the Architect. The Contractor shall be permitted to submit alternative configurations for consideration by the Architect if the alternative configurations do not increase the cost of construction or the schedule.
- B. Canopy: Shop fabricated, shop finished, extruded aluminum decking, (roll-formed not acceptable), outriggers, fascia and hanging rod assemblies free of defects impairing strength, durability or appearance.
 - 1. Configuration: As indicated on drawings.
 - 2. Sizes: As indicated on drawings.
 - 3. Design Criteria: Design and fabricate to resist loads without failure, damage, or permanent deflection as dictated by the applicable building code. Structure shall be capable of sustaining and supporting a concentrated load such as being walked upon.
 - a. For welded material, the tensile ultimate strength, "Ftuw", and tensile yield strength, "Ftyw", shall be used to determine available strength within weld-affected zone.

- b. Design, fabrication, and erection of aluminum load-carrying structures, members, and connections shall be in accordance with AA ADM - Aluminum Design Manual; As Referenced in the International Building Code.
- 4. Finish: Fluoropolymer, AAMA 2605, minimum 70 percent polyvinylidene fluoride, 2 coats, minimum 1.2 mils dry film thickness.
 - a. Pretreated with chrome phosphate conversion coating after cleaning.
 - b. Application by coating manufacturer's approved applicator.
- 5. Finish: Natural anodized, Class I AAMA 611 AA-M12C22A41 or AAMA 612 with electrolytically deposited organic seal; not less than 0.7 mils thick.
- 6. Finish: Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
- 7. Finish Color: Verify and match existing colors at each campus.
- 8. Provide a complete system ready for erection at project site.
- 9. Shop-fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.03 MATERIALS

- A. Aluminum Extrusions: ASTM B209 or B 221.
- 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 A 307 carbon steel.
 - 1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8" outside dimension, conical washer.
 - 2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with aluminum mandrel.
 - 3. Bolts: All bolts, nuts and washers to be 18-8 non-magnetic stainless steel.
 - 4. Tek Screws: not permitted

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 shown on shop drawings.
- C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage 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 the 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/Plumb: 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 the Date of Substantial Completion.

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 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 reproduces is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 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 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.

3.2 DUAL DUCT TERMINAL BOX

- A. Mock-up a Dual Duct Terminal Box completely installed, including:
 1. Electrical connections.
 2. Duct connection beyond first transition.
 3. Cabinet/internal vibration isolation.
 4. Suspension system.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
 1. Control Sequence.
 2. Accessibility to components for service.

3.3 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.

3.4 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: $\frac{1}{4}" = 1'-0"$.
- 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 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 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
 - 15. Wiring for pump motor internal heaters
- 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
 - 10. U.S. Motors
- 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, premium efficiency motors, 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.
- J. Provide TEFC or TEAO motors on all Air Handling Units, Pumps, Supply Fans, Cooling Towers and Fan Coil Units with motors larger than 1 HP.

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.
- C. Install all electrical and control conduit into the bottom only of all electrical enclosures for motors, VFD cabinets, control cabinets, chillers, etc. (No top or side cabinet penetrations) Top of electrical enclosure must be kept water tight. Top or side cabinet penetrations will not be accepted inside or outside of the building.
- D. Motor Connections: For motors 10 HP and larger, at the motor connection do not use wire nuts. Provide listed insulated multitap connectors or provide copper alloy split bolt connection, or compression lugs and bolts: insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape.

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. Fan/Coil Units
 - 3. Air Handling Units
 - 4. Chilled Water Pumps
 - 5. Air Compressor Storage Tanks
 - 6. Equipment Drain Pans

PART 2 – PRODUCTS

2.1 PIPE MATERIAL

- A. Type “L” copper with drainage pattern fittings.
- B. For Air Handling Units – Schedule 40 Galvanized Steel Pipe.

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.
- B. Provide secondary drain line to approved location whenever possible.

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. Variable Volume Air Handling Units.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Air Handling Units
 - 3. 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. Provide a three year parts and labor warranty from date of Substantial Completion. Provide warranty in writing to Owner and HVAC supervisor with applicable warranty coverage dates.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ABB
- B. Danfoss Graham
- C. Yaskawa

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 removeable, gasketed doors with provisions for locking in all Plant locations and pump rooms. 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 inverter.
 - 5. Input overvoltage trip.
 - 6. Input undervoltage (-12%) 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 or 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.

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. Length of wire between Motor and Variable frequency drive shall not exceed 100 feet.
 4. Install all electrical and control conduit into the bottom only of VFD cabinet. (No top or side cabinet penetrations)

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 motor is not in operation at all locations.

3.3 DEMONSTRATION AND TRAINING

- A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives. Provide training plan in writing to owner.
- 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

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 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" 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. Memory stop.
 - b. Plastic drip cap.
 - 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. Kitz (Hot Water Only)
 6. Milwaukee Valve
 7. Keckley
- 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 Duocheck
 - b. Nibco
 - c. Keystone
 - d. Milwaukee Valve
 - e. Keckley
- 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 0.045 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. Zurn
 3. Mueller
 4. Armstrong
 5. Bell & Gossett
 6. Keckley

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
 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
 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. Float valves / stilling wells provided and installed in cooling tower or condenser water basins for water level control. Stilling wells provided around float to prevent turbulence ripples or wind from 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 outside near pump and after pump discharge.

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 OF 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. 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.
- C. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400mm) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at

twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have ½- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm²) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

Flexible expansion joint device shall be provided with a 5-year warranty against leaks and failure.

- D. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400mm) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have ½- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm²) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

- E. 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.
- F. 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 than a steel finish are not acceptable.

- G. 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.
- H. Restrained spring mountings shall have an SLF mounting as described in Specification G, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of ½ inch (12mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position under outdoor equipment there must be an internal isolation pad in addition to the friction pad on the bottom.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Chiller (Campbell, JVHS, Cy-Ranch HS)	A	0.35"
Chiller (Berry Center Only)	A, G & H	2.0"
Pump (Berry Center Only)	F	1.5"

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	C
Suspended Pumps	C
Chiller Pipe Connections	D
Chiller Refrigerant Relief	E

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.
- L. Cooling towers:
 - 1. Verify that cooling towers have been filled and started by others and are in operation.
 - 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure cooling tower fan motor is not in or above the service factor.
 - 3. Test and adjust water flows to balance tower cells and flows between towers.
 - 4. Test and record water temperature profiles of each condenser at design water flow for water and air side operation.
- M. Heat exchangers:
 - 1. Verify that heat exchangers have been filled and started by others, and are in operation.
 - 2. Test and record temperature and pressure profiles of water and steam heat exchangers.

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 (Water Cooled)

- A. Balance flow of water thru each evaporator and condenser 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 and water flow 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 water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
 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.

3.10 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.

[illegible]

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
- E. Expansion tanks, air separators, and volume tanks shall be provided with a access flap or removable section of insulation at vessel nameplate to provide access for inspections.

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, and condensate piping.

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. Koolphen - Phenolic Foam
 - 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. Armstrong 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 3/4" 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 100°F 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 100°F 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 chilled and hot 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 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 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

3.5 MISCELLANEOUS

- A. Insulate chilled water pumps with closed cell insulation box.
- 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.

3.6 INSULATION THICKNESS

THICKNESS	
INSULATED UNIT	(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	1-1/2

END OF SECTION

SECTION 23 0800
HVAC SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

- A. The purpose of this Section is to define responsibilities in the Commissioning Process. Additional system testing is required within individual Specification Sections.
- B. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Division 20-25 Contractors shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- C. HVAC systems to be commissioned include the following:
 - 1. Chillers
 - 2. Boilers
 - 3. Pumps
 - 4. Air Handling Unit Systems
 - 5. DX Split Systems
 - 6. Air Terminal Units (10% Sampling)
 - 7. Fan Coil Units
 - 8. Exhaust and Supply Fan Systems
 - 9. Fire, Fire/Smoke and Volume Dampers (Review of testing documentation provided by the contractor)
 - 10. HVAC / Building Automation System and Integrations
 - 12. HVAC / Emergency Power Source Integrations
 - 13. HVAC / Life Safety Systems Integrations
- D. The TAB Contractor will perform control sequence verification on each terminal unit shall independently verify each sensor and point and document the results to be included in the Final TAB Report. The CxA will commission 10% of the terminal units once TAB is complete with the CSV and point verification of the terminal units.

1.3 DEFINITIONS

- A. Refer to the General Commissioning Requirements for definitions.

1.4 SUBMITTALS

- A. Contractor shall provide Owner and/or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
 - 1. Shop drawings and product submittal data related to systems or equipment to be commissioned.
- B. Contractor shall submit to Owner and/or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- C. Where installation testing may be performed in a progressive manner (i.e., piping hydrostatic testing, ductwork pressure testing, etc.), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive testing will be performed, documented and presented for approval prior to the start of any

testing activities.

- D. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
 - 1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.
 - 2. Installation testing reports such as ductwork pressure testing, piping hydrostatic testing, piping chemical treatment and flushing, bolt flange torqueing, and any documentation associated with local code authority inspections or authorizations.
 - 3. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
 - 4. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process
- C. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

2.2 TEST EQUIPMENT

- A. Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- B. All specialized tools, test equipment, and instruments required to execute Start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

PART 3- EXECUTION

3.1 CONSTRUCTION PHASE

- A. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- B. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.
- C. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- D. Provide additional requested documentation to the Owner and/or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
 - 1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.
 - 2. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor

- and/or CxA.
3. This information and data request may be made prior to normal submittals.
- E. With input from the BAS vendor and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, BAS control drawings, or equipment documentation are not sufficient for writing detailed test procedures.
- F. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- G. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- H. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.
- I. Incorporate manufacturer's Start-up procedures with System Verification Checklists (SVC).
- J. Air and water test, adjust and balance shall be completed with discrepancies and problems remedied before Functional Performance Tests of the respective air or water related systems are executed.
- K. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
- L. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- M. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- N. Provide training of the Owner's operating personnel as specified.
- O. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3.2 WARRANTY PHASE

- A. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.
1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
- B. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.

3.3 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 installation shall be in accordance with the Project Documents.

3.4 TRAINING

- A. Refer to the individual section of this Specification for specific training requirements on each system.
- B. Refer to the General Commissioning Requirements and Division 01 for overall training requirements related to the Commissioning process and this project.

END OF SECTION

SECTION 23 0933
BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. Jersey Village H.S., Berry Center, Campbell M.S., and Cy-Ranch each are controlled by an existing Automated Logic Control system installed by ALC Houston. All new equipment and modifications to existing systems shall be fully integrated into the existing control system including new graphics for all new equipment and is a part of this scope. Upon completion of this project the resulting control system shall have all new controllers for the systems being replaced or added including 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. **In addition, the scope includes upgrading existing BMCS, refer to Article 3.1 for additional information.**
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. 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.
- E. 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
- F. 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.
- G. 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.
- H. **The cost of the work specified in this section is included in an allowance.**
 - 1. **Selection of subcontractor will be determined at a future date.**

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.

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 METERING AND VERIFICATION REQUIREMENTS

- A. This project is a CHPS applicant. Granular data, derived from the BAS and inherent to this specification, is to be handled in such a way as to support this certification. Granular data is defined as temperatures, set points, run times and utility monitoring. This data is to be monitored on a fifteen-minute interval basis and stored in the BAS database. The BAS must have the inherent capability to trend and display all information as described below.
- B. Monitoring software must include outside environmental condition data which affect building performance. Heating degree days and cooling degree days must be logged and formatted in such a way that the data may be used for comparative analysis of multiple facilities, this facility and any CyFair ISD facility on a historical basis over time. This data must be imported from a reliable, certified, third party source. On site instrumentation is not acceptable.
- C. Metering and Verification requirements must be inherent to the BAS. It cannot be a "bolt on" product. It shall be of no extra cost to the project. It shall be easily accessible from the graphical interface on the main screens. It shall also be accessible from the BAS navigation tree. Data must be retrieved and stored in the BAS module until it is archived on the BAS server. Data acquisition and storage must continue even if communication to the facility is lost. Data for utility consumption and environmental indexing must be stored on the server for a minimum of two years.
- D. All data described in this section shall be easily extractable, without external software or programming.

1.6 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion. Warranty shall include unlimited telephone technical support during the warranty period.
- B. Provide DDC controllers with a manufacturer's parts and labor warranty for a period of 5 years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Branch Office – WebCTRL

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
- 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 effective time to start equipment based on historical data.
- B. 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.
- C. 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. Dead band control. Install dual set points as requested by user.
 - 7. 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.
 - 8. Time lapse graphics
 - 9. Global point commands

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. Alphanumeric pagers
 - 2. Numeric pagers
 - 3. Email
 - 4. Phones via voice or short message service (SMS) Text Messaging

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. Variable Refrigerant Volume DX System
 - 6. 100% Outside Air Split System
 - 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.

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 50%
 - 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 beige finish and extruded aluminum alloy frame UL 50 certified.

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 50%.
 14. Actuator input signal shall be compatible with output DDC controller.
 15. Provide weatherproof enclosure (exterior use).
 16. Damper actuators not acceptable for valves.
- G. Cooling Tower By-Pass and Chiller / Cooling Tower Isolation Valves & Actuators:
1. Valve Bray (Series 3L or NYL)
 - a. Line Size Valve
 - b. Under-cut disk for smooth operation
 - c. Full Lug Valve
 - d. Cast Iron Body
 - e. EPDM - Seat
 - f. 416 Stainless Steel Stem
 - g. Nylon Coated Ductile Iron Disc
 - h. Disc-to-stem connection shall utilize a double "D" or key design requiring no screws or pins to connect stem to disc.
 2. Electronic Actuator: Bray (Series 70)
 - a. Fully configurable without need for software or handheld settings device
 - b. Direct Mount
 - c. Solid state speed control
 - d. Visual and electronic stroke indicator.
 - e. Anti-Condensation Heater (exterior actuators)
 - f. Die-cast aluminum housing.
 - g. Manual override by means of hand wheel
 - h. Self-lubricating bearing and gear train.
 - i. All steel self-locking output gearing to be provided
 - j. Continuous Duty Rated Motor
 - k. Overload and stall protection.
 - l. Floating /0-10 VAC / 4-20mA operation.
 - m. Mechanical Travel stops
 - n. UL approved.
 - o. Smooth modulating action.
 - p. Tight close off against the system pressure.
 - q. Sized to exceed 150% of the maximum required operating torque of the valve while under the maximum rated shut-off pressure
 - r. Actuator input signal shall be compatible with output DDC controller.
 - s. Provide weatherproof enclosure
 - t. Damper actuators not acceptable for valves.
- H. Variable Primary Flow By-Pass Control Valve:
1. Modulating straight through control valve with equal percentage contoured throttling plug and electronic operator.
 2. Maximum pressure drop: 10 psi
 3. Sized for minimum flow of one chiller
 4. Torque to exceed the maximum required operating torque by not less than 150%.

2.18 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

2.19 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

2.20 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
 - 1. Thermistor with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.
 - 3. Range of 45° to 95° F operating range.
 - 4. Provide manufacturers calibration certificate.
 - 5. Flush Mounted
 - a. Stainless steel flush mount sensor, submit sample for review.
 - 6. Location and height to be approved by Architect/Engineer prior to installation.
- 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 locking metal covers suitable for institutional use. Submit sample for review.
 - 6. Provide manufacturers calibration certificate.
 - 7. 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 Temperature and Humidity Sensor
 - 1. Temperature
 - a. Range of -40° to 140°F.
 - b. Accuracy shall be +/-0.9°F
 - c. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.
 - 2. Humidity
 - a. 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.
 - b. Accuracy shall be +/-2%
 - c. Range from 20 to 95% RH.
 - d. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 - 3. Weatherproof sun shield consisting of multiple white plastic plates to reduce the thermal effects of the sun and increasing air flow between the plates.
 - 4. Sensor shall be mounted a minimum of 6" from all building structures.
 - 5. Minimum of 8' long leads.
 - 6. Provide manufacturers calibration certificate.
 - 7. Provide with a 5-year warranty
 - 8. Manufactured by ACI Model # A/-RH2-AN-O-SUN---NIST
- F. Freezer / Cooler Sensors
 - 1. Thermistor with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.
 - 3. Range of -40°F to 210°F.
 - 4. Provide manufacturers calibration certificate.
 - 2. Die cast aluminum construction
 - 3. Liquid tight wire connector to isolate sensor chamber from exterior temperature influence.
 - 4. 1/2" NPT threaded hub
 - 5. Mamac Systems Model #TE-205-F-12
 - 6. Reuse existing wiring penetrations through cooler or freezer where possible. If existing penetrations through cooler or freezers cannot be reused, seal existing holes with silicon such that opening is airtight.
 - 7. All new penetrations into the cooler or freezer body shall be sealed airtight using silicon. This shall include screw holes and wiring penetrations.

2.21 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.
 - 8. To be used on towers, vertical turbine pumps, exhaust fans and direct drive

equipment only.

2.22 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

2.23 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.

2.24 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.

2.25 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.

2.26 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
 - 1. Approved manufacturer: Cleveland AFS-460.

2.27 INSERTION FLOW SENSORS

- A. Electromagnetic Flow Meter
 - 1. Retractable hot tap flow sensor
 - 2. Accuracy: +/- 1% of full scale
 - 3. Electromagnetic
 - 4. Custom thread-o-let 400 psi / 250 degree F rated.
 - 5. Line size from 1-1/4 to 72 inch

6. Metering range from 0.3 to 15 f/sec.
7. Remote NEMA 4 wall mounted LCD display
8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer Onicon Flow Meter F3500 or FT3500

2.28 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, sintered 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.

2.29 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

2.30 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps:
 1. Shuts off equipment if water level becomes too high.
 2. DPDT Contacts.

2.31 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

2.32 TEMPERATURE/CO₂ SENSOR

- A. Sensor combo in one housing, Temperature and CO₂.
- B. Provide combo temperature/CO₂ sensor in the following locations:
 - a. Each Classroom
 - b. Library
 - c. Cafeteria
 - d. Gymnasium
- C. 0-2,000 ppm CO₂
- D. CO₂ sensor shall have a self-calibration feature.
- E. Temperature accuracy shall be +/-1/2°F.
- F. Temperature range shall be 32° to 120° F
- G. Location and height to be approved by Architect/Engineer prior to installation.
- H. Internal RJ11 Communication jack at sensor for communications.
- I. Provide metal guards in the following locations:

- a. Corridors
- b. Cafeteria
- c. Kitchen.
- d. Gymnasium.
- e. Dressing Rooms.
- f. Industrial Labs.
- J. Color to be approved by Architect / Owner, submit sample for review.

2.33 AIR FLOW SENSING SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or 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. Field adjustable setpoint
 - 3. Threaded boss conduit entrance
 - 4. SPST Action
 - 5. Voltage and rating as required for the control circuit

2.34 REFRIGERANT MONITOR

- A. Infrared Halogen Gas monitoring system for low level continuous monitoring of numerous CFC, HFC and HCFC halogen gases used in most refrigeration and air conditioning systems.
- B. Two years parts and labor warranty.
- C. Analyzer:
 - 1. Microprocessor based
 - 2. Infrared (IR) sensor technology
 - 3. Sensing down to 1 (PPM)
 - 4. Monitor multiple compounds
 - 5. Automatic calibration
 - 6. Synchronous 2 wave length infrared filterometer
 - 7. Insensitive to vibration and temperature variations.
 - 8. Response Time: Min.5 sec / Max. 90 sec.
 - 9. Sampling Mode in Auto and Manual operation
- D. Multi-Point Sampling System:
 - 1. Minimum of six sample points
 - 2. Adjustable sampling time, with optional skip and hold features for each point.
 - 3. Sample lines up to 500' in length
 - 4. Three stage alarms for each point
 - 5. Flow loss and malfunction indicators
 - 6. Individual relay contacts for each set of channel alarms.
 - 7. Infrared detection
- E. Alarming and Display:
 - 1. Digital display in PPM/PERCENTAGE
 - 2. Provide a 0-10V and 4-20mA output for direct input into the Building Management System or Direct Digital Control System.
 - 3. Adjustable three level alarm for each point shall and be supplied with common alarm output contacts.
 - 4. Provide local digital indication of PPM level for each sample point.
 - 5. Loss of any sample flow

- 6. Identify alarm point by flashing display and actual PPM.
- 7. Automatic zero mechanism and malfunction indicators.
- 8. Silence audible alarm switch with re-activation after adjustable time delay.
- F. Power requirement:
 - 1. 120 VAC
- G. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and providing a distinctive strobe type visual alarm both inside and out side machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strokes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. A clearly identified switch of the break-glass type shall be provided immediately adjacent to and outside of each refrigeration machinery room exit.
- H. Acceptable manufacturers:
 - 1. General Analysis Corporation
 - 2. Yokogawa Corporation
 - 3. MSA
 - 4. Sherlock
 - 5. Vulcain

PART 3 - EXECUTION

3.1 UPGRADE TO EXISTING BMCS SYSTEM(JERSEY VILLAGE H.S., BERRY CENTER, CAMPBELL M.S., CY-RANCH H.S.)

- A. Each scope listed below shall be broken out from the equipment replacement portions of the project in proposal.
- B. Jersey Village High School
 - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey replacement of chilled water plant controllers.
- C. Berry Center
 - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey replacement of chilled water plant controllers.
- D. Campbell Middle School
 - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey replacement of chilled water plant controllers.
- E. Cy-Ranch High School
 - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey replacement of chilled water plant controllers.

3.2 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. The modification and expansion of the existing control system shall include removing any existing control wiring and devices associated with systems being removed.

3.3 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)
 - d. Outside air intakes
 - e. Relief air hoods
- 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 pressure differential 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 pressure differential switch 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. The new BMCS shall integrate all existing fan interlocks.
 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. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor and oil level switch on each cooling tower fan.
- G. 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. Air Cooled Chillers – enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
 - d. Protect heating water 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 heating 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.
- H. 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
- I. HVAC Shutdown Station:
 - 1. Provide an emergency mushroom style push / pull station shutdown switch in a Administration Area or as directed by Owner / Architect.
 - 2. Signal the building automation system to de-energize the HVAC equipment.
 - 3. This is to stop exhaust fans and outside air units immediately.
 - 4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.
 - 5. Once stopped, the system may only be restarted by relatching the emergency push button switch.
- J. Science Room Utility Controllers:
 - 1. Interlock the utility controllers with related air-handling unit through software.
- K. 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.
- L. 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.

3.4 GRAPHICS

- A. Furnish as-built drawings indicating finally 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.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by District. Any changes during the warranty period shall be included.
- F. Provide a summary page for each type of equipment. Summary pages shall be provided for, but not limited to, DDB, EF, AHU, CH, CT, Pumps, and FCU. Summary pages shall include the ability to modify the global set points for each equipment type.
- G. 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.
- 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. System shall include a real time dynamic Central Plant Energy / Status dashboard. Dashboard shall display the following at a minimum:
 1. Actual Plant operating Tons
 2. Total Plant Capacity Available
 3. Percent Usage of Available Capacity
 4. Current Plant operation KW/Ton
 5. Current Chiller KW/Ton
 6. Bar Chart indicating energy consumption by plant component (Chillers, CW Pumps, CHW Pumps and Exhaust Fans)
 7. Tables for Chillers, Chilled Water Pumps, Condenser Water Pumps, and Cooling Tower Fan. The chart shall indicate S/S, Status, KW Consumption, Alarm Status Running AMPS on Chillers.
 7. Trending Graph (Total Chiller KW/Ton and Total Plant KW/Ton)
- K. The modification and expansion of the existing control system shall include removing and updating all graphics to reflect equipment that has been added or removed.

3.5 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. A red-white-red 2"x8" laminated plastic engraved identifying nameplate shall be secured to each audible/visual alarm and emergency shutdown device. Provide identification and location of each A/V device laminated in plastic and hung at refrigerant monitor with identification, location of devices and proper operation of system in a graphic floor plan with written sequence of operation. Identifying nameplates shall have ½ inch high, engraved letters. A red-white-red 12"x12" laminated plastic engraved identifying name plate shall be secured to outside of each door to machine room with "A REFRIGERANT LEAK HAS BEEN DETECTED IN THIS BUILDING WHEN AUDIBLE/VISUAL ALARM IS ENABLED. DO NOT ENTER. CONTACT MAINTENANCE DEPARTMENT."

3.6 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. In addition, furnish, and install all wire, conduit, raceways and cable systems required with the VRF system in the Administration area.
- 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 exposed ceiling 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, Green
 - 2. LAN communications, Yellow
 - 3. All THHN wiring shall comply with Division 26 insulation color identification

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3.7 CHILLED WATER SYSTEM CONTROL

- A. The existing chillers, pumps and portions of the chilled water piping are being replaced. The existing controls sequence shall be reused. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for each chiller as part of the chiller replacement.
- C. This contractor shall remove all existing controls to allow for installation of new chilled water system.
- D. Provide time delays between pump starts and stops to allow system to stabilize.
- E. Change lead/lag rotation on a weekly basis.

- F. Provide interface to each chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller AMPS	DI	Current Sensor
Chiller Alarm Status	DI	Contact
Chiller CHW Supply Temperature	AI	Pipe RTD
Chiller CHW Return Temperature	AI	Pipe RTD
Chiller CW Supply Temperature	AI	Pipe RTD
Chiller CW Return Temperature	AI	Pipe RTD
Chiller CHW Flow Status	DI	Differential Pressure Switch
Chiller CW Flow Status	DI	Differential Pressure Switch
Chiller Reset	AO	Chiller Control Module
Primary Pump Start/Stop	AO	VFD (Each Pump)
Primary Pump Status	DI	Differential Pressure Switch

3.8 CONDENSER WATER CONTROL

- A. The existing condenser water pumps, variable frequency drives and a portion of the piping are being replaced. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for condenser water equipment being replaced as part of the project.
- C. This contractor shall remove all existing controls to allow for installation of condenser water equipment.
- D. The variable frequency drives on the condenser water pumps shall be utilized for soft start and balancing only.

POINT DESCRIPTION	TYPE	DEVICE
Pump Start/Stop	AO	VFD (Each Pump)
Pump Status (Each)	DI	Differential Pressure Switch

3.9 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

- A. Replace the existing refrigerant monitor in the central plant and other locations as required by code as part of the central plant control system upgrade to include all refrigerants to be used in plant upon completion of chiller replacement. Coordinate

- refrigerant type provided with contractor.
- B. Monitor the concentration of refrigerant through an analog input signal through the BMCS. Install (2) sensors at each chiller at opposite ends. Alarm levels of refrigerant concentrations are provided in the Code. Refrigerant levels shall be available at the BMCS.
 - C. Install audible and visual alarms in the area served, at locations as required by code. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and provide a distinctive strobe type visual alarm both inside and outside machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. Provide visual and audible device installed at locations as per local code.
 - D. Provide a clearly identified switches of the break-glass type immediately adjacent to inside and outside of each refrigeration machinery room exit for emergency and activation of the emergency exhaust system and equipment shutdown i.e. chillers and pumps thru safety circuits upon alarm. Mechanical equipment shall be shut down in an orderly manner so as not to damage the equipment. Label switches / buttons per Code.
 - E. Provide a separate emergency ventilation buttons located on the inside the building adjacent to each refrigeration machinery room exit for activation of the central plant emergency ventilation system. Upon alarm either through the refrigerant monitor, by manually pushing the central plant emergency exhaust button or pressing the glass break type switch, the emergency exhaust fan shall be energized. Label switches / buttons per Code.
 - F. Activation of emergency exhaust and equipment shutdown shall signal an alarm to the BMCS and signal the audible and visual alarms in the area served.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shutdown	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
Fan Start/Stop	DO	Control Relay
Fan Status	DI	Current Switch
System Start/Stop	DO	Control Relay

3.10 CHEMICAL TREATMENT SYSTEM

- A. Monitor water treatment power circuit and alarm contacts from water treatment controllers. Provide with cooling tower systems only.

BERRY CENTER

3.11 CHILLED WATER SYSTEM CONTROL

- A. The existing chillers, pumps and portions of the chilled water piping are being replaced. The existing controls sequence shall be reused. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for each chiller as part of the chiller replacement.
- C. This contractor shall remove all existing controls to allow for installation of new chilled

- water system.
- D. Provide time delays between pump starts and stops to allow system to stabilize.
 - E. Change lead/lag rotation on a weekly basis.
 - F. Provide interface to each chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller AMPS	DI	Current Sensor
Chiller Alarm Status	DI	Contact
Chiller CHW Supply Temperature	AI	Pipe RTD
Chiller CHW Return Temperature	AI	Pipe RTD
Chiller CW Supply Temperature	AI	Pipe RTD
Chiller CW Return Temperature	AI	Pipe RTD
Chiller CHW Flow Status	DI	Differential Pressure Switch
Chiller CW Flow Status	DI	Differential Pressure Switch
Chiller Reset	AO	Chiller Control Module
Primary Pump Start/Stop	AO	VFD (Each Pump)
Primary Pump Status	DI	Differential Pressure Switch

3.12 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

- A. Replace the existing refrigerant monitor in the central plant and other locations as required by code as part of the central plant control system upgrade to include all refrigerants to be used in plant upon completion of chiller replacement. Coordinate refrigerant type provided with contractor.
- B. Monitor the concentration of refrigerant through an analog input signal through the BMCS. Install (2) sensors at each chiller at opposite ends. Alarm levels of refrigerant concentrations are provided in the Code. Refrigerant levels shall be available at the BMCS.
- C. Install audible and visual alarms in the area served, at locations as required by code. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and provide a distinctive strobe type visual alarm both inside and outside machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. Provide visual and audible device installed at locations as per local code.
- D. Provide a clearly identified switches of the break-glass type immediately adjacent to inside and outside of each refrigeration machinery room exit for emergency and activation of the emergency exhaust system and equipment shutdown i.e. chillers and pumps thru safety circuits upon alarm. Mechanical equipment shall be shut down in an

- orderly manner so as not to damage the equipment. Label switches / buttons per Code.
- E. Provide a separate emergency ventilation buttons located on the inside the building adjacent to each refrigeration machinery room exit for activation of the central plant emergency ventilation system. Upon alarm either through the refrigerant monitor, by manually pushing the central plant emergency exhaust button or pressing the glass break type switch, the emergency exhaust fan shall be energized. Label switches / buttons per Code.
- F. Activation of emergency exhaust and equipment shutdown shall signal an alarm to the BMCS and signal the audible and visual alarms in the area served.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shutdown	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
Fan Start/Stop	DO	Control Relay
Fan Status	DI	Current Switch
System Start/Stop	DO	Control Relay

3.13 CHEMICAL TREATMENT SYSTEM

- A. Monitor water treatment power circuit and alarm contacts from water treatment controllers. Provide with cooling tower systems only.

CAMPBELL MIDDLE SCHOOL

3.14 EXHAUST FANS

- A. The existing central plant exhaust fan is being replaced with new for increased exhaust volume required.
- B. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- C. Dampers and actuators shall be provided by this contractor and shall not be furnished with the exhaust fan.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Fan Status	DI	Current Sensitive Relay (EF)
Outside Air Damper	DO	Electronic Operator

3.15 CHILLED WATER SYSTEM CONTROL

- A. The existing chillers and portions of the chilled water piping are being replaced. The existing controls sequence shall be reused. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.

- B. Provide updated graphics for each chiller as part of the chiller replacement.
- C. This contractor shall remove all existing controls to allow for installation of new chilled water system.
- D. Provide time delays between pump starts and stops to allow system to stabilize.
- E. Change lead/lag rotation on a weekly basis.
- F. Provide interface to each chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller AMPS	DI	Current Sensor
Chiller Alarm Status	DI	Contact
Chiller CHW Supply Temperature	AI	Pipe RTD
Chiller CHW Return Temperature	AI	Pipe RTD
Chiller CW Supply Temperature	AI	Pipe RTD
Chiller CW Return Temperature	AI	Pipe RTD
Chiller CHW Flow Status	DI	Differential Pressure Switch
Chiller CW Flow Status	DI	Differential Pressure Switch
Chiller Isolation Valve	AO	Electronic Operator
Chiller Differential Water Press.	AI	Pressure Differential Sensor
Chiller Reset	AO	Chiller Control Module
Primary Pump Start/Stop	AO	VFD (Each Pump)
Primary Pump Status	DI	Differential Pressure Switch

3.16 CONDENSER WATER CONTROL

- A. An existing condenser water pump and a portion of the piping are being replaced. All controls and devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for condenser water equipment being replaced as part of the project.
- C. This contractor shall remove all existing controls to allow for installation of condenser water equipment.
- D. The variable frequency drives on the condenser water pumps shall be utilized for soft start and balancing only.

POINT DESCRIPTION	TYPE	DEVICE

POINT DESCRIPTION	TYPE	DEVICE
Pump Start/Stop	AO	Motor Starter
Pump Status	DI	Differential Pressure Switch

3.17 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

- A. Replace the existing refrigerant monitor in the central plant and other locations as required by code as part of the central plant control system upgrade to include all refrigerants to be used in plant upon completion of chiller replacement. Coordinate refrigerant type provided with contractor.
- B. Monitor the concentration of refrigerant through an analog input signal through the BMCS. Install (2) sensors at each chiller at opposite ends. Alarm levels of refrigerant concentrations are provided in the Code. Refrigerant levels shall be available at the BMCS.
- C. Install audible and visual alarms in the area served, at locations as required by code. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and provide a distinctive strobe type visual alarm both inside and outside machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. Provide visual and audible device installed at locations as per local code.
- D. Provide a clearly identified switches of the break-glass type immediately adjacent to inside and outside of each refrigeration machinery room exit for emergency and activation of the emergency exhaust system and equipment shutdown i.e. chillers and pumps thru safety circuits upon alarm. Mechanical equipment shall be shut down in an orderly manner so as not to damage the equipment. Label switches / buttons per Code.
- E. Provide a separate emergency ventilation buttons located on the inside the building adjacent to each refrigeration machinery room exit for activation of the central plant emergency ventilation system. Upon alarm either through the refrigerant monitor, by manually pushing the central plant emergency exhaust button or pressing the glass break type switch, the emergency exhaust fan shall be energized. Label switches / buttons per Code.
- F. Activation of emergency exhaust and equipment shutdown shall signal an alarm to the BMCS and signal the audible and visual alarms in the area served.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shutdown	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
System Start/Stop	DO	Control Relay

CY-RANCH HIGH SCHOOL

3.18 CHILLED WATER SYSTEM CONTROL

- A. The existing chillers, pumps and portions of the chilled water piping are being replaced. The existing controls sequence shall be reused. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for each chiller as part of the chiller replacement.
- C. This contractor shall remove all existing controls to allow for installation of new chilled water system.
- D. Provide time delays between pump starts and stops to allow system to stabilize.
- E. Change lead/lag rotation on a weekly basis.
- G. Provide interface to each chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller AMPS	DI	Current Sensor
Chiller Alarm Status	DI	Contact
Chiller CHW Supply Temperature	AI	Pipe RTD
Chiller CHW Return Temperature	AI	Pipe RTD
Chiller CW Supply Temperature	AI	Pipe RTD
Chiller CW Return Temperature	AI	Pipe RTD
Chiller CHW Flow Status	DI	Differential Pressure Switch
Chiller CW Flow Status	DI	Differential Pressure Switch
Chiller Reset	AO	Chiller Control Module
Primary Pump Start/Stop	AO	VFD (Each Pump)
Primary Pump Status	DI	Differential Pressure Switch

3.19 CONDENSER WATER CONTROL

- A. The existing condenser water pumps, variable frequency drives and a portion of the piping are being replaced. All controls end devices shall be replaced as listed in the points list below. Existing conduit shall be reused and extended.
- B. Provide updated graphics for condenser water equipment being replaced as part of the project.
- C. This contractor shall remove all existing controls to allow for installation of condenser water equipment.
- D. The variable frequency drives on the condenser water pumps shall be utilized for soft start and balancing only.

POINT DESCRIPTION	TYPE	DEVICE

POINT DESCRIPTION	TYPE	DEVICE
Pump Start/Stop	AO	VFD (Each Pump)
Pump Status (Each)	DI	Differential Pressure Switch

3.20 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

- A. Replace the existing refrigerant monitor in the central plant and other locations as required by code as part of the central plant control system upgrade to include all refrigerants to be used in plant upon completion of chiller replacement. Coordinate refrigerant type provided with contractor.
- B. Monitor the concentration of refrigerant through an analog input signal through the BMCS. Install (2) sensors at each chiller at opposite ends. Alarm levels of refrigerant concentrations are provided in the Code. Refrigerant levels shall be available at the BMCS.
- C. Install audible and visual alarms in the area served, at locations as required by code. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and provide a distinctive strobe type visual alarm both inside and outside machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. Provide visual and audible device installed at locations as per local code.
- D. Provide a clearly identified switches of the break-glass type immediately adjacent to inside and outside of each refrigeration machinery room exit for emergency and activation of the emergency exhaust system and equipment shutdown i.e. chillers and pumps thru safety circuits upon alarm. Mechanical equipment shall be shut down in an orderly manner so as not to damage the equipment. Label switches / buttons per Code.
- E. Provide a separate emergency ventilation buttons located on the inside the building adjacent to each refrigeration machinery room exit for activation of the central plant emergency ventilation system. Upon alarm either through the refrigerant monitor, by manually pushing the central plant emergency exhaust button or pressing the glass break type switch, the emergency exhaust fan shall be energized. Label switches / buttons per Code.
- F. Activation of emergency exhaust and equipment shutdown shall signal an alarm to the BMCS and signal the audible and visual alarms in the area served.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shutdown	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
Fan Start/Stop	DO	Control Relay
Fan Status	DI	Current Switch
System Start/Stop	DO	Control Relay

3.21 CHEMICAL TREATMENT SYSTEM

- A. Monitor water treatment power circuit and alarm contacts from water treatment controllers. Provide with cooling tower systems only.

3.22 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
 - 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

- g. 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.

3.23 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.

3.24 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.

3.25 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 is being replaced. The items listed below shall be furnished and/or installed by this contractor.

PART 2 - PRODUCTS

2.1 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 manufacturer, 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		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 PIPE STANDS

- A. Refer to Pipe Stand detail included in drawings for additional information.
- B. All ground mounted pipe stands shall be steel construction and hot dipped galvanized after fabrication.
- C. All pipe stand bases shall be anchored, leveled and grouted to ensure equal weight distribution.

3.8 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.

3.9 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

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 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.

3.11 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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 21 13
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 schedule 80 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 schedule 80 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. 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.
- 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. Air and Dirt Separators shall be a full flow coalescing type combination air eliminator and dirt separator. The separator shall be designed for full flow high volume systems. The inlet and outlet connections shall be the same as adjoining pipe. Vessel shall be

fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet and outlet nozzles. The vessel shall include copper or stainless steel coalescing medium to aid in the separation of air and dirt in the system entrained water. Air elimination efficiency shall be 100% free air, 100% entrained air, and a minimum of 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. Unit shall be provided with a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. Unit shall be provided with all options to allow for ground mounting and support from bottom of separator.

1. Acceptable manufacturer shall be Spirovent Series HD by Spirotherm, TACO 4900, Thrush Standard Velocity.

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.
- B. Install air vent 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 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 – tire coupling element, Dura-Flex type
 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. Falk all-metal center dropout spacer coupling
 7. Totally enclosed metal or high-impact polyethylene plastic (Orange Peel) coupling guard per ANSI B15.1, Section 8 and OSHA 1910.219
 8. Suction and discharge flange gauge ports
 9. Fully enclosed bronze impeller keyed to the shaft
 10. 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. 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
- E. Paint entire unit with two coats of machinery enamel after completion of installation.
- F. 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%
- G. 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)
- H. 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.
- I. Acceptable manufacturers:
1. Bell & Gossett
 2. Armstrong
 3. Aurora
 4. Taco
 5. Grundfos
 6. Patterson

2.2 VERTICAL TURBINE CONDENSER WATER PUMP

- A. Pump Construction:
1. Pump bowls shall be flanged and bolted, made of cast iron. Flanges shall be of sufficient cross-section to prevent deflection.
 2. Impellers shall be bronze enclosed type, secured to the shaft with steel tapered collets.
 3. Pump bowls shall be provided with replaceable bronze wear rings.
 4. Pump shaft shall be of stainless steel, rolled or forged, ground and sized to provide minimum deflection.
 5. Belled suction of cast iron.
- B. Bearings:
1. Bronze sleeve bearings shall be provided in each bowl and in the suction bell.
 2. Bowl bearings shall be lubricated by the pumped liquid.
 3. Suction bell bearing shall be packed permanently with non-soluble grease and fitted with a bronze sand collar with a 200,000 hour minimum rating.
- C. Column Assembly:
1. Discharge column pipe for 10" pumps and larger shall be steel with flanged connections.
 2. Discharge column pipe for 8" pumps and smaller shall be with flanged or threaded connections.
 3. Line shafting shall be steel, rolled or forged and ground. Shaft sections shall be

- connected through steel threaded couplings. Minimum shaft size is 1".
 - 4. Provide water lubricated cutless rubber bearings with bronze retainers at each column connection.
- D. Surface Discharge Head Assembly:
 - 1. Above-ground mounting of close-grained cast iron with an integral discharge flange. Flange shall be 150 lb. ANSI flat face type.
 - 2. The discharge head base shall be of sufficient size and shall conform to ANSI flange drilling as required to span an opening of dimensions that shall permit removal of the complete pump unit connected below.
 - 3. Provide two lifting lugs with capacity to support the weight of the entire pump.
- E. Provide each pump with packing material stuffing box.
 - 1. Cast iron stuffing box and stainless steel gland bolts.
 - 2. Bronze seal box bearing
 - 3. John Crane 1345
- F. Pump shall be provided with a basket type suction strainer of bronze or stainless steel. The net open area of the strainer shall be at least twice the area at the suction bell lip.
- G. Pump motor:
 - 1. Vertical direct connected.
 - 2. Constant speed.
 - 3. Premium Efficiency TEFC suitable for use outdoors.
 - 4. 90% efficiency at loads of 75% through 100%.
 - 5. So sized with relation to the pump impeller that the brake horsepower requirement will not overload the motor at any point on the pump curve.
 - 6. Non-reverse ratchet
 - 7. Provide motor internal heater for prevention of condensation.
- H. 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)
- I. 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.
- J. Acceptable Manufacturers:
 - 1. Peabody Flo-way
 - 2. Peerless
 - 3. Taco
 - 4. Patterson

2.3 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 316 stainless steel pump shaft.
 5. Coupling: Rigid spacer type of high tensile aluminum alloy. 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. Natatorium pumps shall utilize a cast 316 stainless steel impeller and a ductile iron casing with fusion bonded epoxy coating to withstand corrosion caused by chlorinated water.
- 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.
 4. Manufacturer, address, telephone number
 5. Pump model number
 6. Pump serial number
 7. Size (including impeller diameter scheduled in inches)
 8. Type
 9. Equipment designation as listed on the pump schedule.
 10. Flow scheduled (gallons per minute)
 11. Dynamic head scheduled (feet of water)
 12. Efficiency (percent)
 13. Shut-off head (feet of water)
 14. Speed (rpm)
 15. Brake horsepower
 16. Maximum brake horsepower with rated impeller
 17. Rotation
 18. 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. Bell & Gossett
 2. Armstrong Series 4300
 3. Aurora
 4. Taco
 5. Grundfos
 6. Patterson

2.4 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 a minimum of 24" 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.
 - 10. Reference section 23 05 13 Article 3.1 paragraph D for motor wiring connectors.
- 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. An extra packing box rebuild kit and 5 packing rings for each condenser water pump.
 - 2. An extra mechanical seal for each vertical inline pump.
 - 3. A set of bearings for each horizontal pump.

END OF SECTION

SECTION 23 2124
CONDENSER WATER PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED WORK

- A. Division 23 Mechanical
 - 1. Pipe and Pipe Fittings - General
 - 2. Valves, Strainer and Vents
 - 3. Vibration Isolation
 - 4. Painting

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Aboveground.
 - 1. 2" or smaller diameter pipe: Provide ASTM A #53 Grade A or B or ASTM A 120, Sch. 40 seamless or electric-resistance welded black steel pipe with 150 lb. screwed malleable iron fittings, ANSI B16.3.
 - 2. 2-1/2" through 6" pipe: Provide ASTM A #53 Grade A or B or ASTM A 120, Sch. 40 seamless or electric-resistance welded black steel pipe with standard weight seamless steel welding fittings, ASTM A 234, Grade WPA or WPB, ANSI B16.9.
 - 3. 8" through 20" pipe: Furnish ASTM A 53, Grade A or B, Sch. 20, seamless or electric-resistance welded black steel pipe with standard weight seamless steel welding fittings, ASTM A 234, Grade WPA or WPB, ANSI B16.9.
 - 4. 24" and larger diameter pipe: ASTM A 53, Grade A or B, 0.375" wall seamless or electric-resistance welded black steel pipe with seamless steel welding fittings, 0.375" wall, ASTM A 234, Grade WPA or WPB, ANSI B16.9. At Contractor's option, pipe sizes over 24" outside diameter can be ASTM A 134 with mitered fittings using ASTM A 285, Grade B or C steel plate.
- B. Exterior Above Grade:
 - 1. Galvanized steel pipe, Schedule 40
 - 2. Fitting: Grooved

2.2 VALVES

- A. Refer to Section 23 05 23.
- B. Refer to Building Management and Control System.

PART 3 - EXECUTION

3.1 TESTING

- A. Apply a hydraulic pressure of 1-1/2 times 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 the water drained.

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
- D. Entire existing chilled water system shall be fully cleaned and flushed prior to the operation of chillers.
- E. Test all existing closed and open water systems and provide report to Owner and Engineer.

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

- C. Agency and that are labeled as required by law.
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. Nalco Water – Ecolab (Contact Danny Short 832-823-9716, danny.short@ecolab.com)

2.2 CLOSED CHILLED AND HOT WATER SYSTEM

- A. Side stream stainless steel filter feeders in the hot water and chilled water systems:
1. Rated at 40-gpm capacity.
 2. Operating conditions: 200 psig and 250°F.
 3. Single filter cartridge.
 4. Cartridge #:
 - a. NALCO 231-FMPIC405HT
 - b. WATTS #FMPIC405HT
 5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
 6. Provide sufficient quantity of filter cartridges for warranty period. Minimum of two additional cartridges provided to owner.
 7. Provide (2) two drains for filter housing. (1) clean water drain, (1) dirty water drain.
- B. Acceptable Manufacturers: Side Stream Cartridge Filter Housing
1. NALCO #231-FMJCH40
 2. WATTS #FMJCH40
- C. Treatment chemicals:
1. Furnished as a concentrated liquid in 5 gallon pails
 2. A corrosion inhibitor of the nitrite-borate type equal to Nalco 2534.
 3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500 in hot loops.
 4. With effective copper and black iron corrosion inhibitors.
 5. Form a protective film to prevent corrosion and scale formation.
 6. Have colored dye to indicate presence.
 7. Compatible with all system elements.
- D. Multiple chemicals used in a common system shall be compatible.

2.3 CONDENSER WATER SYSTEM

- A. Prefabricated Panel Mounted Automatic System consisting of the following for each chiller / cooling tower:
1. 1 each Conductivity controller.
 2. 3 each Chemical feed pumps.
 3. Sample stream piping assembly on high-density polyethylene panel.
 4. Prefabricated panel with stainless steel hardware utilized in securing system components.
 5. System sample stream piping assembly shall be constructed of schedule 80 CPVC, and shall consist of inlet and outlet ball valves, clear Y strainer, sample valve, conductivity electrode, three chemical injection stations and flow switch.
- B. Conductivity Controller:
1. The Controller shall be a microprocessor based, menu driven industrial type conductivity controller.
 2. With relay activated on/off control outputs.
 3. 0-1000 microsiemen control range with displayable a 16 character, backlit LCD display.

4. Adjustable High/Low alarm points with output relays and 4-20ma output.
5. The controller shall provide four programmable, non-concurrent operational modes for inhibitor feed using either:
 - a. Feed as % of bleed.
 - b. Feed and bleed with limit timer.
 - c. Percent of time.
 - d. Water meter triggered feed.
6. The Controller shall provide 2 two independent programmable biocide feed functions programmable in cycle modes of 1 to 4 weeks.
7. An adjustable pre-bleed function based on time or conductivity and programmable lockout feature shall be provided for each individual biocide feed.
8. Controller shall be an LMI model DC-4500111A1 or approved equivalent.
- C. Chemical Metering Pumps:
 1. Chemical metering pumps shall be positive displacement, Liquifram type pumps.
 2. Output volume shall be adjustable while pumps are in operation from 0 to maximum capacity of 14 Gallons per day.
 3. Adjustment shall be by readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency.
 4. On-off switch shall be integral with frequency control.
 5. Chemical pumps shall be capable, without a hydraulically backed diaphragm, of injecting chemicals against pressures.
 6. Valves shall be cartridge type and renewable by replacing only the cartridge.
 7. Pump head and fittings shall be of PVDF or CPVC construction.
 8. Chemical pumps shall be LMI Model A141-352SI or approved equivalent.
- D. Water Meter for Cooling Tower Make-Up:
 1. Electric Contacting Head Water meter which shall be a multi jet design with bronze body and sealed register sized for required make-up flow.
- E. Blow-Down Assembly:
 1. 120V actuator with ball valve. Belimo ball valve model B225VS and actuator model SY1-110.
 2. Pre-fabricated Blow-down with isolation valve and “y”-strainer sized for required blow-down.

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 fore 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.
- 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. 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.
- C. Duct cleaning: Oil film on sheet metal should be removed before shipment to site. On-site, inspect ducts to confirm that no oil film is present. Remove any oil. If ducts contain dust and dirt, clean them immediately, prior to substantial completion and prior to using the ducts to circulate air. HVAC system components or duct work may only be cleaned, coated, or have applied to its surface disinfectants, pesticides or biocides that are registered and particularly labeled for use in HVAC systems by state and federal EPA.

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 submit 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.
- E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
- F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
- G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

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
- B. Pressure rating and tests as specified for single wall ductwork.

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. 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. 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
 7. Price

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 Manufacturers
 - 1. Ruskin
 - 2. Prefco
 - 3. Air Balance
 - 4. Phillips
 - 5. Safe-Air
 - 6. Nailor Industries

2.9 WALL LOUVERS

- A. 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. All louvers shall be certified to meet the wind zone requirements of project location.
- E. 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 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.

2.12 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

2.13 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

2.14 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
 - 6. Price

2.15 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
 - 6. Price

2.16 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

2.17 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.

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 and downstream)
 - 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 braced and rigidly braced with galvanized angles. Gages 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. All condensate producing equipment installed above ceilings and in central plant area shall be provided with a welded stainless steel secondary drain pan installed below equipment entirely and extend a minimum of 4" beyond equipment footprint.
- B. With 3/4" welded nipple.
- C. Piped to local floor drains or floor sinks.

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 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.

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 approved safety screen where inlet or outlet is exposed.
- D. Provide duct flanges where required for connections.
- E. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- F. 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.

2.7 OSCILLATING AIR CIRCULATOR FAN

- A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
- B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
- C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
- D. Wall Mounted
- E. Factory wired 10', 3 conductor with ground molded plug
- F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

2.8 AUXILIARY ANGLE FILTER

- A. Provide a duct mounted inline low velocity angled filter box for the outside air supply systems.
- B. Filter box shall be upstream of any ductwork taps to VAV boxes.
- C. Maximum pressure drop shall be 0.5 inches static pressure.
- D. Provide continuous filter rails and a double wall hinged access door to allow easy filter replacement.
- E. Filter box shall be installed with a maximum height of 6'-0".
- F. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings.
- 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 6416
CENTRIFUGAL LIQUID CHILLING MACHINE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a factory assembled, electric-driven, water-cooled, water chilling unit, with centrifugal compressor. Provide a packaged centrifugal water-cooled liquid chiller as specified with all controls and variable frequency drive necessary for automatic operation mounted on the machine.
- B. Section includes design, performance criteria, refrigerants, controls, and installation requirements for water-cooled magnetic bearing chillers.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Chilled Water Piping
 - 2. Condenser Water Piping
 - 3. Vibration Isolation
 - 4. Controls
 - 5. Electrical Provisions of Mechanical Work
- B. Comply with applicable Standard/Codes of ARI 550/590, ANSI/ASHRAE 15, ANSI B31.5, ASME Section VIII, ASTM, NEMA, NEC, UL984, and OSHA as adopted by the State.

1.3 PERFORMANCE

- A. Furnish a unit with minimum capacity and characteristics as scheduled, allowing for 0.0001 fouling factor in the cooler and 0.00025 fouling factor in the condenser.

1.4 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit manufacturer's installation, start-up and service/maintenance instructions.
- C. Submit the following information:
 - 1. Manufacturer's installation instructions.
 - 2. Minimum Circuit Ampacity.
 - 3. Maximum Overcurrent Protection.
 - 4. Maximum conductor / Terminal Lug size.
 - 5. Minimum flow thru evaporator.
 - 6. Electrical interlocks.
- D. Submit recommended service clearance dimensions.
- E. Submit internal wiring diagram of Control Center.
- F. Submit product data on centrifugal chiller starter and harmonic filter.
- G. Submit AHRI certified performance data and energy consumption at design conditions and partial load operation of 25, 50, 75, and 100% loads with constant entering condenser water temperature at design conditions as specified.
- H. 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.
- I. Submit shop drawings showing the placement of the water box connection after visiting the project. Match existing piping connections.
- J. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.5 DELIVERY/STORAGE/HANDLING

- A. Ship machine without initial charge of refrigerant and lubricating oil. The initial charge shall be supplied, shipped in containers and cylinders for field installation by the

- Manufacturer's service technician.
- B. All equipment and accessories shall be suitably boxed, crated, covered with a tarp, and protected internally and externally to prevent shipping damage and damage from the weather.
- C. Manufacturer shall provide quick shipment options to minimize product lead times.

1.6 WARRANTY

- A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty 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.
- B. The Chiller manufacturer shall provide a compressor and motor parts only extended warranty for a total of 10 years.

1.7 PREVENTATIVE MAINTENANCE SERVICE AGREEMENT

- A. Furnish service and maintenance agreement of chillers for a period of 5 years from date of substantial completion. Include quarterly system examinations, required adjustments, and control calibrations. Repair/replace parts in accordance with manufacturer's recommendations. All work performed by manufacturer technicians. Maintenance agreement shall include the following items as a minimum:
 - a. Analyze compressor fault log (quarterly)
 - b. Check IGV operation (quarterly)
 - c. Check controls settings for proper configuration (quarterly)
 - d. Verify transducers and sensors for accuracy (quarterly)
 - e. Analyze controls log and faults (quarterly)
 - f. Confirm correct water flow and pressure drop for both evaporator and condenser (quarterly)
 - g. Evaluate the test/performance (quarterly)
 - h. Leak test entire unit (quarterly)
 - i. Check and record line voltage (quarterly)
 - j. Inspect power components for signs of overheating (quarterly)
 - k. Check and tighten all electrical components (annually)
 - l. Perform moisture prevention (annually)
 - m. Clean and leak test condenser tubes (annually)
 - n. Clean the evaporator and condenser flow sensor (annually)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Trane

2.2 HERMETIC MOTOR AND COMPRESSOR

- A. Multiple single stage compressors.

- B. Or single multi-stage high performance compressor.
- C. Motor, transmission and compressor hermetically sealed into a common assembly.
- D. Provide isolation valves to allow filter change with out removal of refrigerant charge.
- E. Variable Evaporator Flow Capability: All chillers shall be applied in variable evaporator flow (VPF) system and able to withstand a chilled water flow rate-of-change of twenty-five percent (25%) per minute while maintaining plus or minus two (+/- 2 F) of design supply chilled water temperature, and fifty percent (50%) per minute at any load above the compressor minimum without cycling "off" on low load (low leaving water temperature) or evaporator refrigerant temperature limit.
- F. Motors shall have winding RTD's for temperature sensing on each phase. Thermistors and thermal overloads are not acceptable. These temperatures shall be furnished to the unit control panel for monitoring and alarm.

2.3 LIQUID COOLER

- A. Cooler Components
 - 1. Shell-and-tube heat exchanger.
 - 2. Cleanable copper tubes with continuous 0.025-inch thickness from tube root to root.
 - 3. Removable heads.
 - 4. Nonferrous tubes and baffles for maximum corrosion resistance.
 - 5. Provide 150 psig working pressure water side construction.
 - 6. Provide 1.5 times the working pressure refrigerant side construction.
- B. Select the cooler with the fouling factor shown in the schedule.
- C. Provide grooved connections for piping connections.
- D. Include pressure relief devices sized to meet the requirements of ASHRAE 15.
- E. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.
- F. An electronic expansion valve shall control refrigerant flow to the evaporator.

2.4 WATER COOLED CONDENSER

- A. Condenser components:
 - 1. Shell-and-tube heat exchanger.
 - 2. Cleanable copper tubes with continuous 0.025-inch thickness from tube root to root.
 - 3. Removable heads.
 - 4. Seamless internally and externally enhanced copper tubes. Tubes shall be removable from both ends.
 - 5. Provide 150 psig working pressure water side construction.
 - 6. Provide 1.5 times the working pressure refrigerant side construction.
- B. Select the condenser with the fouling factor shown in the schedule.
- C. Provide marine water box with hinged barrel head or hinged barrel head as specified on drawings. Provide with vent and drain connections.
- D. Provide grooved connections for piping connections.
- E. Pressure relief devices sized to meet the requirements of ASHRAE 15.
- F. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.

2.5 PURGE UNIT

- A. High efficiency purge unit with positive means for collection and return of refrigerant, removal of noncondensables, water vapor and shall confirm to requirements of ASHRAE 15. Provide indicating message on control panel of abnormal air leak or excessive purging. The purge unit shall be refrigerant cooled. Include operating controls, piping, and refrigerant service valves to isolate the purge unit from the chiller all factory installed. Purge unit shall automatically alarm (local and remote relay) if excess purging is

detected.

2.6 REFRIGERANT RELIEF VALVE

- A. All chiller relief points shall be installed as required by the manufacturer and latest edition of ASHRAE 15.
- B. Provide chillers with reseating relief valves or rupture disks per ASHRAE standard 15.

2.7 POWER CONNECTIONS

- A. Power connection shall be single point to a factory-mounted disconnect switch.

2.8 CONTROLS AND INSTRUMENT PANEL

- A. Operation. For constant flow applications, automatically modulate the compressor through controls actuated by changes in the temperature of water leaving the chiller. For variable flow applications, modulate each compressor through changes in the temperature of water leaving the chiller. Start the compressors unloaded.
- B. Furnish a complete a microprocessor-based control system consisting of a 12.1-inch color LCD touch-screen operator interface and a unit controller that is factory mounted, wired, and tested. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:
 - 1. Chilled water temperatures - supply and return.
 - 2. Condenser water temperatures - supply and return.
 - 3. Refrigerant pressures - evaporator and condenser.
 - 4. Motor current in % full load amps.
 - 5. Saturation temperatures - evaporator and condenser.
 - 6. Water flow indication.
 - 7. Oil temperature.
 - 8. Percent of capacity operation of compressor vanes position.
 - 9. Three phase volts and three phase amps.
 - 10. Elapsed time meter and number of compressor starts.
 - 11. Oil pressure at compressor.
 - 12. Alarm and failure messages.
 - 13. Diagnostics Service Log
 - 14. Motor winding temperature.
 - 15. Bearing oil temperature.
 - 16. Operating hours
 - 17. Number of starts
- C. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following set points must be monitored:
 - 1. Chilled water supply temperature.
 - 2. Current limit.
 - 3. Pull down demand limit.
 - 4. Remote reset temperature range.
 - 5. Remote alarm contact.
 - 6. Compressor actual speed, maximum speed, percent speed
 - 7. Liquid line temperature
 - 8. Compressor and unit state and input and output digital and analog valuesAny input that potentially harms the machine shall be rejected and the operator shall be advised via display message. All system shutdowns (safety or cycling) shall be preserved (until the system is reset with pass-word or restarted) in the microcomputer's memory for subsequent viewing on the alphanumeric display. The operator shall be continuously

- advised of system operating conditions by various background and warning messages. The keypad shall contain special service passwords for use by service technicians when performing system troubleshooting.
- D. Safety controls shall be annunciated through the alphanumeric display consisting of day, time of shutdown, cause of shutdown, and type of restart required. Safety controls with automatic unit shutdown shall be provided for:
1. Sensor malfunction.
 2. High and low compressor oil pressure.
 3. High and low refrigerant pressure
 4. High compressor discharge temperature.
 5. Low evaporator pressure or high condenser pressure.
 6. Low chilled water temperature.
 7. High oil temperature.
 8. Starter fault.
 9. Unit shall not start without minimum flow through the evaporator or the condenser.
 10. Clogged oil filter.
 11. Low oil pressure.
 12. Freeze protection.
 13. High discharge and low evaporator pressure cutout.
 14. Chilled water freeze protection.
 15. Loss of evaporator or condenser water flow.
 16. Phase loss, phase reversal, phase imbalance, and under or over voltage protection.
 17. Chilled water differential pressure switch to prove flow.
 18. Condenser water differential pressure switch to prove flow.
- E. Battery backup shall be provided to keep all Setpoints in memory for minimum of one month in case of power failure. Control Center shall provide for an automatic restart of chiller after a momentary power failure. Provide battery backup for all volatile memory setpoints.
1. Minimum of one month in case of power failure.
 2. Automatic battery recharging.
 3. Low battery charge alarm.
- F. Chilled water flow detection devices shall be provided to shut down unit when flow drops below minimum through evaporator or condenser.
- G. Security access shall be provided to prevent unauthorized change of Setpoints, reset failures and to allow local or remote control of the chiller.
- H. The Microcomputer Control Center shall provide interface that includes as a minimum:
1. Remote start.
 2. Remote stop.
 3. Remote leaving chilled water temperature setpoint and reset.
 4. Remote current limit setpoint.
 5. Ready to start status contact.
 6. Safety shutdown status contacts.
 7. Cycling shutdown status contacts.
 8. Compressor run relay contacts.
 9. Common alarm contact.
 10. Purge Alarm Relay
 11. Head Pressure Relief Relay
 12. Provide BacNET interface
 13. Alarm Relay
 14. Percent of Running Load Amperage
- I. Provide a relay control to signal the chilled and condenser water pumps. Provide a 30 second time delay between sequential ancillary equipment starts.

- J. Provide an “auto restart after power failure” control with manual reset for oil temperature low limit control.
- K. Power factor correction capacitors resulting full load power factor to 95%. Provide non-PCB unit with discharge resistor. PFCC shall be factory mounted and wired by the chiller manufacturer.
- L. Provide controls to enable chiller to operate with 57 degree entering condenser water temperature.
- M. The factory supplied VFD and controls should include the following:
 - 1. High short circuit panel rating of 65kA with a matching circuit breaker
 - 2. Phase loss protection
 - 3. Under/over voltage protection
- N. Energy saving software logic shall at a minimum offer the following
 - 1. User programmable compressor soft loading
 - 2. Chilled water reset
 - 3. Demand limit control
 - 4. Staging options lead lag between multiple compressors on a single chiller or on multiple chillers
 - 5. Plotting of historic trends for optimizing efficiency

2.9 CAPACITY CONTROLS

- A. Solid state electronic.
- B. Fully automatic.
- C. Regulate chilled water temperature.
- D. Prevent motor overload by control of compressor guide vane positioner.
- E. Provide capacity modulation from 100% to 15% of full load under design conditions shown in the schedule. Provide chiller capable of operation without surge, cavitation, or undue vibration from full load to 15% load without hot gas bypass when supplied with design entering condenser water quantity. AHRI certified unloading report to be included in submittal.
- F. Provide leaving chilled water control within +/- 1.0°F (0.6°C) at a water flow rate change of 10% per minute and will stay online at a water flow rate change of 30% per minute.

2.10 SAFETY CONTROLS

- A. Electric/electronic and fully automatic.
- B. Fail-safe.
- C. Provide machine shutdown for:
 - 1. Low oil pressure.
 - 2. Low chilled water temperature.
 - 3. Low cooler pressure.
 - 4. High condenser pressure.
 - 5. High bearing oil temperature.
 - 6. High compressor discharge temperature.
 - 7. High motor winding temperature (hermetic machines).
- D. Insure thorough lubrication of compressor prior to start and during coast down after machine stop signal.
- E. Protect motor against drawing more than rated full load amperes.
- F. Prevent machine restart until after a safe pre-set time.
- G. Provide a demand limiter device so that maximum current can be set to any percentage between 40 and 100% of full load amperes.
- H. Surge capacitors and Lighting Arrestor.
- I. Provide factory-mounted and wired, differential pressure flow switches on each vessel to prevent unit operation with no or low water flow.

2.11 REMOTE MONITORING INSTRUMENTATION

- A. Provide non-energized auxiliary contacts for remote monitoring of chiller operating conditions extend wiring to identified terminal strip.
- B. Provide for normal system operation mode: Two normally open contacts.
- C. Provide for system safety shutdown mode: Two normally open contacts.
- D. Provide circuitry to allow remote discrimination between cycling and safety shutdown. Provide separate contact closure to indicate the chiller will start (all safeties and cycling devices satisfied) when a remote start signal is received.

2.12 REFRIGERANT

- A. Provide refrigerant type R-513a. Refrigerant shall comply with current ASHRAE Standard 15 and other governing authorities.

2.13 VIBRATION ISOLATION

- A. Refer to section 23 0548 for exact requirements. Contractor to coordinate.

2.14 VARIABLE SPEED DRIVES

- A. A refrigerant cooled variable speed drive shall be factory supplied and installed on the chiller. It shall vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The package shall include adaptive capacity control logic to automatically adjust the motor speed and compressor pre-rotation vane position independently. The control system shall provide maximum operating efficiency at all loads and water temperatures by analyzing information fed to it via sensors located throughout the chiller. Drive shall be PWM type utilizing IGBT's with a power factor of 0.95 or better at all loads and speeds. Drives that do not provide power factor correction are not acceptable.
 - 1. The variable speed drive shall be unit mounted in a NEMA-1 enclosure with all power and control wiring between the drive and the chiller factory installed, including the power to the chiller pump. Field power wiring shall be a single point connection and electrical lugs for incoming power wiring shall be provided. The entire chiller/drive package shall be UL listed. To minimize motor peak voltages to within acceptable motor insulation design limits, motor lead limits shall not exceed 18". The chiller/drive assembly shall undergo an electrical and mechanical run test prior to shipment.
 - 2. The following features shall be provided:
 - a. A door interlocked circuit breaker capable of being padlocked.
 - 1) UL listed ground fault protection.
 - 2) Over voltage and under voltage protection.
 - 3) 3 phase sensing motor overcurrent protection.
 - 4) Single phase protection.
 - 5) Insensitive to phase rotation.
 - 6) Over temperature protection.
 - 7) Digital readout at the chiller unit control panel of:
 - (a) Output Frequency
 - i. Output Voltage
 - ii. 3 phase output current.
 - (b) Input Kilowatts (kW) and Kilowatt-hours(kWh)
 - i. Self diagnostic service parameters.

2.15 HARMONIC FILTER

- A. Provide factory unit Mounted harmonic filter that limits electrical power supply distortion to 5% TDD for current (5% TDD limits as defined by IEEE 519 specifications) from the variable speed drive. The filter shall be mounted in a NEMA -1 enclosure and shall be UL listed. The following digital readouts shall be provided at the chiller unit control panel as part of the filter package:
 - 1. Input KVA
 - a. Total power factor.
 - b. 3 phase input voltage
 - c. 3 phase input current
 - d. 3 phase input voltage total harmonic distortion (THD)
 - e. 3 phase input current total demand distortion (TDD)
 - f. Self diagnostic service parameters
 - 2. AHRI certified chiller performance shall take into account energy losses due to harmonic filtration.

PART 3 - EXECUTION

3.1 HANDLING & INSTALLATION

- A. Install new chiller and align new chiller on concrete foundations, sole plates and sub-bases. Adjust and level chiller in alignment on supports and grout in place.
- B. Provide neoprene vibration isolation bonded to steel.
- C. Install the system in accordance with the manufacturer's installation instructions.
- D. Arrange piping for easy dismantling to permit tube cleaning and service.
- E. Pipe the chiller rupture disc to outdoors; size discharge piping as recommended by the chiller manufacturer.
- F. Install condenser water modulating valve and controls to enable chiller to operate with 40 degree entering condenser water temperature.
- G. Coordinate electrical installation with the electrical contractor.
- H. Coordinate controls with the control contractor.
- I. Provide all appurtenances required to ensure a fully operational and functional chiller.
- J. Prior to chiller start-up, verify that the water treatment equipment has been properly installed and is in working condition. Do not operate the equipment for any reason until the complete circulating condenser water chemical treatment system is operational as specified.
- K. Do not install paddle flow switches. Wet DP switches only. DP switches shall be installed per manufacturers recommendations.
- L. Do not operate the equipment for any reason until the complete circulating condenser water temperature controls are operational.
- M. All electrical conduits shall be connected to chiller in the bottom of electrical cabinet. Top and side connections are not acceptable.

3.2 INSULATION (FIELD APPLIED)

- A. Field applied after installation prior to start-up.
- B. Flexible closed cell foam. Two 3/4" layers, overlapping seams of the first layer.
- C. Apply insulation, vapor proof cement and enamel paint (color to match chiller) to:
 - 1. Cooler shell.
 - 2. Float chamber.
 - 3. End sheets.
 - 4. Waterboxes
 - 4. Suction connection.
 - 5. Motor cooling connection (hermetic machines).
 - 6. Necessary auxiliary tubing.
 - 7. Other components subject to surface condensation.
- D. Resistant Coating

1. WB Armaflex Finish
2. Apply weather protective finish on elastomeric insulation. Provide a minimum of three coats.
3. Color to match chiller manufacturer's equipment.

3.3 CHILLER MANUFACTURER START-UP SERVICE

- 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 trained and experienced in the work they perform. (Contractor startup is unacceptable.) Sample forms shall be submitted for approval before starting work.
- B. The technician 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 technician and included in the final report and Owner's manual.
- D. Submit four copies of the final report to the Architect/Engineer 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.
 8. Verify correct interface between Building Management Control System and chiller control panel.
- F. Measure and record the following data:
 1. Chilled and condenser water entering/leaving temperature.
 2. Chilled and condenser water flow through the chiller.
 3. Suction pressure/condensing pressure.
 4. Suction pressure/unloading steps.
 5. Air entering/leaving cooling tower wet / dry bulb temperature.
 6. Outdoor ambient; wet / 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. Measure the chiller control signal. Compare to the manufacturer's instructions. Calibrate and adjust the signal through all stages of operation.
- I. If the system has been shipped with a holding charge:
 1. Leak test.
 2. Refrigerant pressure test.
 3. Evacuate, dehydrate and charge.
- J. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.
- K. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion after a complete startup procedure.
- L. Do not operate the equipment for any reason until the factory start-up service has been completed.
- M. Provide a printout from the unit microcomputer control system showing the correct operation of all system controls and components.
- N. Do not operate the equipment for any reason until the complete circulating condenser water chemical treatment system is operational as specified.

- O. Do not operate the equipment for any reason until the complete circulating condenser water temperature controls are operational under Section 23 09 33 as specified.

3.4 TRAINING

- A. The manufacturer shall provide, as part of their proposal, training two Owner representatives for a two-day training session.
- B. Training shall include hands on and classroom type training which pertains to the purchased equipment. The training shall give the trainees the ability to completely tear down and overhaul the purchased equipment. Any and all literature, manual or information shall be given to the trainees.

3.5 ADDITIONAL REQUIREMENTS

- A. The manufacturer is to supply two complete sets of maintenance manuals for the chiller. The manual should be a complete overhaul and maintenance manual. Detailed drawings of all internal parts and complete parts list shall be provided with the chillers.

3.6 FACTORY CERTIFIED TESTING

- A. Certified Capacity Testing
 1. Test each chiller at a test facility certified by AHRI.
 2. Perform certified tests in accordance with the current edition of AHRI Standard 550.
 3. Chiller shall deliver at minimum the specified cooling capacity at design conditions and the maximum KW/ton shall not exceed 105% of the specified values.
 4. The test shall include computations for adjusted test results to reflect the fouling factors as specified.
 5. Completed test results for each chiller shall be submitted to the Engineer, certifying the design capacity and Maximum KW/ton at the design point.
 6. The test results shall be certified by an officer of the Manufacturer.
 7. If chiller fails to meet the scheduled capacity, the manufacturer shall revise the equipment to achieve the scheduled capacity requirements and conduct a new test after revisions to the equipment are made.
- B. Certified Tube Thickness Testing
 1. Perform certified eddy current testing on all tubes both the condenser and evaporator to certify tube thickness meets or exceeds the specified thickness value from root to root. Provide certified report of testing to owner to use as a baseline for comparison to future testing.

3.7 LIFE CYCLE COST ANALYSIS

- A. Manufacturer to provide efficiencies at the following four points to allow for an energy analysis to be performed by the engineer:
 1. A= KW/ton @ 95% load and 82.0 degrees ECWT (41%)
 2. B= KW/ton @ 75% load and 76.8 degrees ECWT (40%)
 3. C= KW/ton @ 50% load and 74.1 degrees ECWT (16%)
 4. D= KW/ton @ 25% load and 62.8 degrees ECWT (3%)

END OF SECTION

SECTION 23 6417
MAGNETIC BEARING CENTRIFUGAL LIQUID CHILLING MACHINE

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a factory assembled, electric-driven, water-cooled, water chilling unit, with oil-free, magnetic bearing, semi-hermetic centrifugal compressor with all controls and starter necessary for automatic operation mounted on the machine.
- B. Section includes design, performance criteria, refrigerants, controls, and installation requirements for water-cooled magnetic bearing chillers.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Chilled Water Piping
 - 2. Condenser Water Piping
 - 3. Vibration Isolation
 - 4. Controls
 - 5. Electrical Provisions of Mechanical Work
- B. Comply with applicable Standard/Codes of ARI 550/590, ANSI/ASHRAE 15, ANSI B31.5, ASME Section VIII, ASTM, NEMA, NEC, UL984, and OSHA as adopted by the State.

1.3 PERFORMANCE

- A. Furnish a unit with minimum capacity and characteristics as scheduled, allowing for 0.0001 fouling factor in the cooler and 0.00025 fouling factor in the condenser.

1.4 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit manufacturer's installation, start-up and service/maintenance instructions.
- C. Submit the following information:
 - 1. Manufacturer's installation instructions.
 - 2. Minimum Circuit Ampacity.
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1.5 DELIVERY/STORAGE/HANDLING

- A. Ship machine without initial charge of refrigerant and lubricating oil. The initial charge shall be supplied, shipped in containers and cylinders for field installation by the Manufacturer's service technician.

- B. All equipment and accessories shall be suitably boxed, crated, covered with a tarp, and protected internally and externally to prevent shipping damage and damage from the weather.
- C. Manufacturer shall provide quick shipment options to minimize product lead times.

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- A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty 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.
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 - f. Confirm correct water flow and pressure drop for both evaporator and condenser (quarterly)
 - g. Evaluate the test/performance (quarterly)
 - h. Leak test entire unit (quarterly)
 - i. Check and record line voltage (quarterly)
 - j. Inspect power components for signs of overheating (quarterly)
 - k. Check and tighten all electrical components (annually)
 - l. Perform moisture prevention (annually)
 - m. Clean and leak test condenser tubes (annually)
 - n. Clean the evaporator and condenser flow sensor (annually)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. Trane

2.2 SEMI-HERMETIC MOTOR AND COMPRESSOR

- A. The unit shall utilize magnetic bearing, oil-free, semi-hermetic centrifugal compressors.

- The levitated shaft position shall be digitally controlled and shall be monitored by X-axis position sensor, Y-axis position sensor, and Z-axis position sensor. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure by diverting stored power to the magnetic bearing controls system.
- B. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be compatible with variable frequency drive operation.
 - C. The chiller shall be equipped with an integrated Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. Movable inlet guide vanes and variable compressor speed acting together, shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.
 - D. Each compressor circuit shall be equipped with a 5% rated line reactor to help protect against incoming power surges and help reduce harmonic distortion.
 - E. The unit shall have a minimum of a 0.90 power factor at compressor full load.
 - F. Variable Evaporator Flow Capability: All chillers shall be applied in variable evaporator flow (VPF) system and able to withstand a chilled water flow rate-of-change of twenty-five percent (25%) per minute while maintaining plus or minus two (+/- 2 F) of design supply chilled water temperature, and fifty percent (50%) per minute at any load above the compressor minimum without cycling "off" on low load (low leaving water temperature) or evaporator refrigerant temperature limit.
 - G. Motors shall have winding RTD's for temperature sensing on each phase. Thermistors and thermal overloads are not acceptable. These temperatures shall be furnished to the unit control panel for monitoring and alarm.

2.3 LIQUID COOLER

- A. Cooler Components
 1. Shell-and-tube heat exchanger.
 2. Cleanable copper tubes with continuous 0.025 inch thickness from tube root to root.
 3. Removable heads.
 4. Nonferrous tubes and baffles for maximum corrosion resistance.
 5. Provide 150 psig working pressure water side construction.
 6. Provide 200 psig working pressure refrigerant side construction.
- B. Select the cooler with the fouling factor shown in the schedule.
- C. Provide grooved connections for water boxes.
- D. Include pressure relief devices sized to meet the requirements of ASHRAE 15.
- E. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.
- F. An electronic expansion valve shall control refrigerant flow to the evaporator.

2.4 WATER COOLED CONDENSER

- A. Condenser components:
 1. Shell-and-tube heat exchanger.
 2. Cleanable copper tubes with continuous 0.025-inch thickness from tube root to root.
 3. Removable heads.
 4. Seamless internally and externally enhanced copper tubes. Tubes shall be removable from both ends.
 5. Provide 150 psig working pressure water side construction.
 6. Provide 1.5 times the working pressure refrigerant side construction.
- B. Select the condenser with the fouling factor shown in the schedule.
- C. Provide marine water box with hinged barrel head or hinged barrel head as specified on

- drawings. Provide with vent and drain connections.
- D. Provide grooved connections for piping connections.
- E. Pressure relief devices sized to meet the requirements of ASHRAE 15.
- F. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.

2.5 REFRIGERANT RELIEF VALVE

- A. All chiller relief points shall be installed as required by the manufacturer and latest edition of ASHRAE 15.
- B. Provide chillers with reseating relief valves or rupture disks per ASHRAE standard 15.

2.6 REFRIGERANT ISOLATION

- A. Provide unit with manually operated isolation valves located at the inlet and outlet of the condenser. Condenser shall be able to store the entire system refrigerant charge during servicing. Provide service valves to facilitate removal of the refrigerant from the system. Check valves are not approved for isolation. If isolation valves cannot be provided, the chiller manufacturer shall provide a separate refrigerant transfer/storage unit to hold one chillers full refrigerant charge when 90% full.

2.7 POWER CONNECTIONS

- A. Power connection shall be single point to a factory-mounted disconnect switch.

2.8 CONTROLS AND INSTRUMENT PANEL

- A. Operation. For constant flow applications, automatically modulate the compressor through controls actuated by changes in the temperature of water leaving the chiller. For variable flow applications, modulate each compressor through changes in the temperature of water leaving the chiller. Start the compressors unloaded.
- B. Furnish a complete a microprocessor-based control system consisting of a 15-inch VGA touch-screen operator interface and a unit controller that is factory mounted, wired, and tested. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:
 - 1. Chilled water temperatures - supply and return.
 - 2. Condenser water temperatures - supply and return.
 - 3. Refrigerant pressures - evaporator and condenser.
 - 4. Motor current in % full load amps.
 - 5. Saturation temperatures - evaporator and condenser.
 - 6. Water flow indication.
 - 7. Oil temperature.
 - 8. Percent of capacity operation of compressor vanes position.
 - 9. Three phase volts and three phase amps.
 - 10. Elapsed time meter and number of compressor starts.
 - 11. Oil pressure at compressor.
 - 12. Alarm and failure messages.
 - 13. Diagnostics Service Log
 - 14. Motor winding temperature on hermetic units only.
 - 15. Bearing oil temperature.
 - 16. Operating hours
 - 17. Number of starts
- C. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following set points must be monitored:

1. Chilled water supply temperature.
 2. Current limit.
 3. Pull down demand limit.
 4. Remote reset temperature range.
 5. Remote alarm contact.
 6. Compressor actual speed, maximum speed, percent speed
 7. Liquid line temperature
 8. Compressor and unit state and input and output digital and analog values: Any input that potentially harms the machine shall be rejected and the operator shall be advised via display message. All system shutdowns (safety or cycling) shall be preserved (until the system is reset with password or restarted) in the microcomputer's memory for subsequent viewing on the alphanumeric display. The operator shall be continuously advised of system operating conditions by various background and warning messages. The keypad shall contain special service passwords for use by service technicians when performing system troubleshooting.
- D. Safety controls shall be annunciated through the touch-screen display consisting of day, time of shutdown, cause of shutdown, and type of restart required. Safety controls with automatic unit shutdown shall be provided for:
1. Sensor malfunction.
 2. High and low compressor oil pressure.
 3. High and low refrigerant pressure
 4. High compressor discharge temperature.
 5. Low evaporator pressure or high condenser pressure.
 6. Low chilled water temperature.
 7. High oil temperature.
 8. Starter fault.
 9. Unit shall not start without minimum flow through the evaporator or the condenser.
 10. Clogged oil filter.
 11. Low oil pressure.
 12. Freeze protection.
 13. High discharge and low evaporator pressure cutout.
 14. Chilled water freeze protection.
 15. Loss of evaporator or condenser water flow.
 16. Phase loss, phase reversal, phase imbalance, and under or over voltage protection.
 17. Chilled water differential pressure switch to prove flow.
 18. Condenser water differential pressure switch to prove flow.
- E. Battery backup shall be provided to keep all Setpoints in memory for minimum of one month in case of power failure. Control Center shall provide for an automatic restart of chiller after a momentary power failure. Provide battery backup for all volatile memory setpoints.
1. Minimum of one month in case of power failure.
 2. Automatic battery recharging.
 3. Low battery charge alarm.
- F. Chilled water flow detection devices shall be provided to shut down unit when flow drops below minimum through evaporator or condenser.
- G. Security access shall be provided to prevent unauthorized change of Setpoints, reset failures and to allow local or remote control of the chiller.
- H. The Microcomputer Control Center shall provide interface that includes as a minimum:
1. Remote start.
 2. Remote stop.
 3. Remote leaving chilled water temperature setpoint and reset.

4. Remote current limit setpoint.
5. Ready to start status contact.
6. Safety shutdown status contacts.
7. Cycling shutdown status contacts.
8. Compressor run relay contacts.
9. Common alarm contact.
10. Purge Alarm Relay
11. Head Pressure Relief Relay
12. Provide BacNET interface
13. Alarm Relay
14. Percent of Running Load Amperage
- I. Provide a relay control to signal the chilled and condenser water pumps and cooling tower. Provide a 30 second time delay between sequential ancillary equipment starts.
- J. Provide an "auto restart after power failure" control with manual reset for oil temperature low limit control.
- K. Power factor correction capacitors resulting full load power factor to 95%. Provide non-PCB unit with discharge resistor. PFCC shall be factory mounted and wired by the chiller manufacturer.
- L. Provide valves and controls to enable chiller to operate with 40 degree entering condenser water temperature.
- M. The factory supplied VFD and controls should include the following:
 1. High short circuit panel rating of 35kA with a matching circuit breaker
 2. Phase loss protection
 3. Under/over voltage protection
- N. Energy saving software logic shall at a minimum offer the following
 1. User programmable compressor soft loading
 2. Chilled water reset
 3. Demand limit control
 4. Staging options lead lag between multiple compressors on a single chiller or on multiple chillers
 5. Plotting of historic trends for optimizing efficiency

2.9 CAPACITY CONTROLS

- A. Solid state electronic.
- B. Fully automatic.
- C. Regulate chilled water temperature.
- D. Prevent motor overload by control of compressor guide vane positioner.
- E. Provide capacity modulation from 100% to 15% of full load under design conditions shown in the schedule. Provide chiller capable of operation without surge, cavitation, or undue vibration from full load to 15% load without hot gas bypass when supplied with design entering condenser water quantity. AHRI certified unloading report to be included in submittal.
- F. Provide leaving chilled water control within +/- 1.0°F (0.6°C) at a water flow rate change of 10% per minute and will stay online at a water flow rate change of 30% per minute.

2.10 SAFETY CONTROLS

- A. Electric/electronic and fully automatic.
- B. Fail-safe.
- C. Provide machine shutdown for:
 1. Low oil pressure.
 2. Low chilled water temperature.
 3. Low cooler pressure.
 4. High condenser pressure.
 5. High bearing oil temperature.

- 6. High compressor discharge temperature.
- 7. High motor winding temperature (hermetic machines).
- D. Insure thorough lubrication of compressor prior to start and during coast down after machine stop signal.
- E. Protect motor against drawing more than rated full load amperes.
- F. Prevent machine restart until after a safe pre-set time.
- G. Provide a demand limiter device so that maximum current can be set to any percentage between 40 and 100% of full load amperes.
- H. Surge capacitors and Lighting Arrestor
- I. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow.

2.11 REMOTE MONITORING INSTRUMENTATION

- A. Provide non-energized auxiliary contacts for remote monitoring of chiller operating conditions extend wiring to identified terminal strip.
- B. Provide for normal system operation mode: Two normally open contacts.
- C. Provide for system safety shutdown mode: Two normally open contacts.
- D. Provide circuitry to allow remote discrimination between cycling and safety shutdown. Provide separate contact closure to indicate the chiller will start (all safeties and cycling devices satisfied) when a remote start signal is received.

2.12 REFRIGERANT

- A. Provide refrigerant type R-513a or R-515b. Refrigerant shall comply with current ASHRAE Standard 15 and other governing authorities.

2.13 VIBRATION ISOLATION

- A. Refer to section 23 0548 for exact requirements. Contractor to coordinate.

2.14 VARIABLE SPEED DRIVES

- A. A refrigerant cooled variable speed drive shall be factory installed on the chiller. It shall vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The package shall include adaptive capacity control logic to automatically adjust the motor speed and compressor pre-rotation vane position independently. The control system shall provide maximum operating efficiency at all loads and water temperatures by analyzing information fed to it via sensors located throughout the chiller. Drive shall be PWM type utilizing IGBT's with a power factor of 0.95 or better at all loads and speeds. Drives that do not provide power factor correction are not acceptable.
 - 1. The variable speed drive shall be unit mounted in a NEMA-1 enclosure with all power and control wiring between the drive and the chiller factory installed, including the power to the chiller pump. Field power wiring shall be a single point connection and electrical lugs for incoming power wiring shall be provided. The entire chiller/drive package shall be UL listed. To minimize motor peak voltages to within acceptable motor insulation design limits, motor lead limits shall not exceed 18". The chiller/drive assembly shall undergo an electrical and mechanical run test prior to shipment. Water cooled drives are not acceptable.
 - 2. The following features shall be provided:
 - a. A door interlocked circuit breaker capable of being padlocked.
 - 1) UL listed ground fault protection.
 - 2) Over voltage and under voltage protection.
 - 3) 3 phase sensing motor overcurrent protection.
 - 4) Single phase protection.
 - 5) Insensitive to phase rotation.
 - 6) Over temperature protection.

- 7) Digital readout at the chiller unit control panel of:
 - a) Output Frequency
 - (1) Output Voltage
 - (2) 3 phase output current.
 - b) Input Kilowatts (kW) and Kilowatt-hours(kWh)
 - (1) Self-diagnostic service parameters.

2.15 HARMONIC FILTER

- A. Provide factory unit Mounted harmonic filter that limits electrical power supply distortion to 5% TDD for current (5% TDD limits as defined by IEEE 519 specifications) from the variable speed drive. The filter shall be mounted in a NEMA -1 enclosure and shall be UL listed. The following digital readouts shall be provided at the chiller unit control panel as part of the filter package:
 - 1. Input KVA
 - a. Total power factor.
 - b. 3 phase input voltage
 - c. 3 phase input current
 - d. 3 phase input voltage total harmonic distortion (THD)
 - e. 3 phase input current total demand distortion (TDD)
 - f. Self diagnostic service parameters
 - 2. AHRI certified chiller performance shall take into account energy losses due to harmonic filtration.

PART 3 - EXECUTION

3.1 HANDLING & INSTALLATION

- A. Install new chiller and align new chiller on concrete foundations, sole plates and sub-bases. Adjust and level chiller in alignment on supports and grout in place.
- B. Provide neoprene vibration isolation bonded to steel.
- C. Install the system in accordance with the manufacturer's installation instructions.
- D. Arrange piping for easy dismantling to permit tube cleaning and service.
- E. Pipe the chiller rupture disc to outdoors; size discharge piping as recommended by the chiller manufacturer.
- F. Install condenser water modulating valve and controls to enable chiller to operate with 40 degree entering condenser water temperature.
- G. Coordinate electrical installation with the electrical contractor.
- H. Coordinate controls with the control contractor.
- I. Provide all appurtenances required to ensure a fully operational and functional chiller.
- J. Prior to chiller start-up, verify that the water treatment equipment has been properly installed and is in working condition. Do not operate the equipment for any reason until the complete circulating condenser water chemical treatment system is operational as specified.
- K. Do not install paddle flow switches. Wet DP switches only. DP switches shall be installed per manufacturers recommendations.
- L. Do not operate the equipment for any reason until the complete circulating condenser water temperature controls are operational.
- M. All electrical conduits shall be connected to chiller in the bottom of electrical cabinet. Top and side connections are not acceptable.

3.2 INSULATION (FIELD APPLIED)

- A. Field applied after installation prior to start-up.
- B. Flexible closed cell foam. Two 3/4" layers, overlapping seams of the first layer.
- C. Apply insulation, vapor proof cement and enamel paint (color to match chiller) to:
 - 1. Cooler shell.
 - 2. Float chamber.
 - 3. End sheets.

4. Waterboxes
5. Suction connection.
6. Motor cooling connection (hermetic machines).
7. Necessary auxiliary tubing.
8. Other components subject to surface condensation.
- D. Resistant Coating
 1. WB Armaflex Finish
 2. Apply weather protective finish on elastomeric insulation. Provide a minimum of three coats.
 3. Color to match chiller manufacturer's equipment.

3.3 CHILLER MANUFACTURER START-UP SERVICE

- 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 trained and experienced in the work they perform. (Contractor startup is unacceptable.)
- B. The technician 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 technician and included in the final report and Owner's manual.
- D. Submit four copies of the final report to the Architect/Engineer 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.
 8. Verify correct interface between Building Management Control System and chiller control panel.
- F. Measure and record the following data:
 1. Chilled and condenser water entering/leaving temperature.
 2. Chilled and condenser water flow through the chiller.
 3. Suction pressure/condensing pressure.
 4. Suction pressure/unloading steps.
 5. Air entering/leaving cooling tower wet / dry bulb temperature.
 6. Outdoor ambient; wet / 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. Measure the chiller control signal. Compare to the manufacturer's instructions. Calibrate and adjust the signal through all stages of operation.
- I. If the system has been shipped with a holding charge:
 1. Leak test.
 2. Refrigerant pressure test.
 3. Evacuate, dehydrate and charge.
- J. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.
- K. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion after a complete startup procedure.

- L. Do not operate the equipment for any reason until the factory start-up service has been completed.
- M. Provide a printout from the unit microcomputer control system showing the correct operation of all system controls and components.
- N. Do not operate the equipment for any reason until the complete circulating condenser water chemical treatment system is operational as specified.
- O. Do not operate the equipment for any reason until the complete circulating condenser water temperature controls are operational under Section 23 09 33 as specified.

3.4 TRAINING

- A. The manufacturer shall provide, as part of their proposal, training two Owner representatives for a two-day training session.
- B. Training shall include hands on and classroom type training which pertains to the purchased equipment. The training shall give the trainees the ability to completely tear down and overhaul the purchased equipment. Any and all literature, manual or information shall be given to the trainees.

3.5 ADDITIONAL REQUIREMENTS

- A. The manufacturer is to supply two complete sets of maintenance manuals for the chiller. The manual should be a complete overhaul and maintenance manual. Detailed drawings of all internal parts and complete parts list shall be provided with the chillers.

3.6 FACTORY CERTIFIED TESTING

- A. Certified Capacity Testing
 - 1. Test each chiller at a test facility certified by AHRI.
 - 2. Perform certified tests in accordance with the current edition of AHRI Standard 550.
 - 3. Chiller shall deliver at minimum the specified cooling capacity at design conditions and the maximum KW/ton shall not exceed 105% of the specified values.
 - 4. The test shall include computations for adjusted test results to reflect the fouling factors as specified.
 - 5. Completed test results for each chiller shall be submitted to the Engineer, certifying the design capacity and Maximum KW/ton at the design point.
 - 6. The test results shall be certified by an officer of the Manufacturer.
 - 7. If chiller fails to meet the scheduled capacity, the manufacturer shall revise the equipment to achieve the scheduled capacity requirements and conduct a new test after revisions to the equipment are made.
- B. Certified Tube Thickness Testing
 - 1. Perform certified eddy current testing on all tubes both the condenser and evaporator to certify tube thickness meets or exceed the specified thickness value from root to root. Provide certified report of testing to owner to use as a baseline for comparison to future testing.

3.7 LIFE CYCLE COST ANALYSIS

- A. Manufacturer to provide efficiencies at the following four points to allow for an energy analysis to be performed by the engineer:
 - 1. A= KW/ton @ 95% load and 82.0 degrees ECWT (41%)
 - 2. B= KW/ton @ 75% load and 76.8 degrees ECWT (40%)
 - 3. C= KW/ton @ 50% load and 74.1 degrees ECWT (16%)
 - 4. D= KW/ton @ 25% load and 62.8 degrees ECWT (3%)

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 completed manuals in final electronic 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. Complete electronic 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 Plants* ("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. IEEE 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 1100™, *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, reproducible 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 1/4-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.
Example: Panel HA
 Fed From MSB
 Located Main Elec. RM 100
Example: Disconnect for Panel LK
 Location: Kitchen
 Fed From Transformer TLK
 Located Main Elec. RM 100
- 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 1/4-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 West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Receptacle Contactor C2 Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	

- 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.
 - j. 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
 - k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
 - l. Switchgear, switchboards, panelboards, motor control centers, or service equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record’s seal on the Construction Documents. Example:
AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY
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.
- G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

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 25 hours total dedicated instructor time allocated across all campuses as needed or as directed by the Owner.
 - 2. 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 TM
 3. Working distance calculated in accordance with IEEE Std 1584a TM
 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: $\frac{3}{4}$ 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_unbalance_d_motor-systems7.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 luminaire 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.

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 CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. 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 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 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 MOCKUPS

- 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.
- B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.
- C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.
- D. Mock up ten feet of cable tray including all supports, hardware and bonding.

END OF SECTION

**SECTION 26 0512
ELECTRICAL 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. Provide individual submittals based on the project specification section number and description and only items specified or required in that specific project specification section.
- C. Submit product data shop drawings only for the following items indicated below when included as part of the project specifications, 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, typically for basic materials and commodity off-the-shelf materials, and/or to imply that materials shall be provided as specified without exception.
- D. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- E. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, in the related O&M manual section.

1.2 ARCHITECT / ENGINEER REVIEW OF SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review requested submittals with reasonable promptness. Specific equipment submittal within a materials specification section 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 exceptions to submittal as submitted.
 - 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 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 product or material substitution employing the procedures of this Section. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 – PRODUCTS

- A. Each individual submittal shall be an individual specific electronic data file with the file

name resembling the product specification section number and title. Refer to Division 01 for additional data file format and media requirements.

PART 3 – EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

- A. Do not submit an outline form of compliance, submit a complete copy with the product data.
- B. Mark up a complete copy of the complete 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:).
- C. Variances for product or materials typically include updated model numbers or updated versions of the specified product from the same manufacture or an equal or better product from the approved manufactures list. Substitutions from manufacture's not on the approved manufacture's will not be reviewed unless prior approval using one of the procedures for substitutions or changes in the contract documents are followed as required in Division 01.

3.2 COMPOSITE COORDINATION DRAWINGS

- A. Produce a set of composite coordination drawings for above ceiling, below ceiling, and below floor of electrical, mechanical, and technology equipment rooms and equipment yards for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of items including but not limited to structural and architectural elements, all mechanical and plumbing piping, ductwork, equipment, electrical conduit, low voltage communications and safety/security systems cabling, cable trays, lighting, electrical switchgear, generators and UPSs, and any public or private building utility services.
 - 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. Do not submit entire product catalogs, submit only specific data sheets indicating

- required product information and available product options or accessories.
- 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
 - c. Additional identifiers as required in Division 01.
 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 submitted or delivered.
- C. All product options specified shall be clearly indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as either part of or not part of the product data submitted shall become part of the Contract and shall be assumed to be provided with the product submitted.
- D. Mark each copy of standard manufacture's printed data to identify pertinent products, referenced to specification section and article number.
- E. Show reference standards, performance characteristics and capacities; wiring 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 or strike through 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.
- K. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other electrical switchgear dependent on the results of the study for specific product selection by the vendor or contractor for compliance with the study.
1. The emergency life safety power system equipment shall be fully coordinated as required by the NEC.
 2. The AIC and WCR ratings of all products meet or exceed the available fault current at that equipment's location.
 3. Electrical systems other than life safety power systems shall be coordinated as much as practicable while reducing arc flash energy as much as practical.
- L. Required submittals when products are indicated or specified:
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, load centers, 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. Metering equipment for energy monitoring and usage
16. Emergency/Standby generator sets and transfer switches
17. Surface Raceways
18. Architectural Dimming Systems
19. Theatrical Lighting Systems
20. Motor Control Center renewal parts

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, make corrections or annotations for clarification of manufacturer supplied data, stamp and sign submittals prior to transmittal.
- B. Determine and verify:
 1. Field measurements
 2. Field construction criteria
 3. Manufacturer's catalog numbers
 4. Conformance with the 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 required, until such submittals have been produced and bear contractor's stamp of acceptance or approval. Do not fabricate products or begin work until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors, omissions, or un-approved substitutions 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; manufacture's and code required clearances.
 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. General and Electrical Contractor's Stamp of Approval
 1. The general contractor and the electrical 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. Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions or coordination drawings.
 2. Product Data: Submit electronic data PDF files. Refer to Division 01 for specific requirements. PDF files that are 20MB or larger may indicate that a submittal includes information not specifically relevant to the specific product being provided, information not required for the review of the specific product such as a complete product catalog or catalog section. Contractor shall include only the product data required to review the specific products characteristics for compliance with the contract documents.
- C. Accompany submittals with transmittal letter containing:
 1. Date
 2. Project title and number
 3. Contractor's name, address and contact information.
 4. The number of each Shop Drawing, Project Datum and Sample submitted
 5. Other pertinent data as required in Division 01.
- 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
 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 additional changes which have been made by the contractor other than those requested by the Architect / Engineer.

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 manufactured in the USA.
- B. Types: The types of conductors and connectors required for the project include the following:
 - 1. 600V building conductors
 - 2. 600V building conductor connectors
 - 3. 600V 2-hour fire rated power cable
- 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 – Provide products manufactured in the USA

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. Insulation for 2-hour fire rated power cables: Insulation shall meet or exceed the requirements of UL 2196 Fire Test for Electrical Circuit Protection Systems, and UL 44, Standards for Fire Resistive Cable. Conductor ampacity shall be based on 75C. Combination UL Type insulation types are permissible where the required UL Type is part of the combination UL listing.

1. Conductors installed underground: Insulation for underground fire rated conductors shall be wet location, UL Type RHW 75 degrees C, or UL RHW-2 90 degrees C.
 2. Conductors installed above ground: Insulation for above ground fire rated conductors shall be UL Type RHH 90C or RHW 75C or UL RHW-2 90C.
 3. Electrical Circuit Protective Systems (FHIT) – System 27 of the UL Fire Resistance Directory
- E. 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 from 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.
 - a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
 - c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
 - e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
 - f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
- 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. Two-hour fire rated cable:
1. Two-hour fire rated power cable shall be installed per manufacturer's installation instructions in compliance with UL Fire Resistance Directory, Electrical Circuit Protective Systems (FHIT), and System 27.
 2. Two-hour fire rated power cable shall be installed in rigid steel EMT or rigid steel galvanized conduit (RGC) with steel fittings. Provide fire rated sealant to the end of the raceway to prevent gases from migrating from the fire rated cable into the equipment.
 3. Provide two-hour rated cable where conduit or cables enters or passes through the building envelope at areas or rooms that are not two-hour rated equipment rooms for the following:
 - a. Fire Pump feeders.
 - b. Emergency Feeders (Life Safety) as defined by NFPA Article 700.
 - c. Legally required level one standby systems as defined by NFPA 110 and NFPA Article 701. These systems include but are not limited to those used to aid firefighting and rescue operations, smoke removal systems, and elevators designated for ADA and/or fire rescue operations.
 4. Alternate two hour rated feeder conductor sizes may be substituted for the required conductor ampacity, voltage drop, or equipment lug terminations based on two-hour fire rated conductor standard size availability or provided equipment manufacturer's cable terminations. The substituted conductor ampacity shall meet or exceed the specified cable ampacity and exceed the required equipment minimum circuit ampacity. Provide substitutions and the required conduit sets and sizes as required for the substitutions at no additional cost to the Owner.
- E. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- F. 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. Push-in type connectors are prohibited.
 - 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.
- 3. Motor connections:
 - a. All AHU motors connections shall be split bolt connectors.
 - b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
 - c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.
- G. 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.
- H. 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 SYSTEMS OVER 600 VOLTS

- A. Provide insulated grounding bushings at each new/relocated conduit termination. The grounding system shall be made continuous with bare copper jumpers.
 - 1. Connect the copper grounding jumpers to the ground bus in the equipment.
- B. Install a grounding conductor in each conduit.
 - 1. 600 V code gauge Type XHHW.
 - 2. Green insulation.
- C. Connect the grounding conductor to:
 - 1. Each new/relocated/reused splice or pull box enclosure.
 - 2. Each new/relocated/reused transformer enclosure.
 - 3. All new/relocated/reused primary switchgear enclosures.

3.3 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.

3.4 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.5 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 – Provide products manufactured in the USA

- 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: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
 - 3. Stainless Steel: Robroy, Calbrite, Gibson
 - 4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
- B. Fittings:
 - 1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Racor, Ipex, International Metal Hose, Lew Electric Fittings Co.
 - 2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
 - 3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
 - 4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
- C. Condulets and Conduit Bodies:
 - 1. Appleton, Form 85
 - 2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions
 - 3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
- D. Steel MC Cable for light fixture whips:
 - 1. AFC
 - 2. Southwire
 - 3. General Cable
 - 4. Kaf-Tech

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 shall be ¾-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. 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
 - 2. Insulated throat connectors
 - 3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
 - 4. Cast metal fittings are not approved
 - 5. Uni-couple type connectors are not approved
 - 6. Split ring, anti-short bushings are not approved

2.5 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 H₂O 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 conduit 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

2.6 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

2.7 PVC CONDUIT

- A. UL labeled Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. Acceptable PVC conduit manufacturer: Ipex, Cantex

2.8 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

2.9 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.

2.10 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.

2.11 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

2.12 EXTERIOR IN-GRADE PULL BOXES

- A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
 - 1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.
 - 2. Conduit entry knock-outs as required
 - 3. Bolt down galvanized steel/cast iron covers
 - 4. Thin wall knocks outs as required
 - 4. Integral bottom
 - 5. Box height as required for specified conduit depth and required top elevation.
 - 6. Concrete design strength of minimum 5,500 PSI at 28-days
 - 7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
 - 8. Size and volume as required for application.

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 as 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 and all bushings 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 pouring.
 - 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 the following: motorized equipment, transformers, interior light fixtures above ceilings, and power poles. They shall not be used in lieu of rigid conduit runs. They shall not be used for wall or roof penetrations except for exterior building mounted light fixtures and 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 steel 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.
 - b. Where subject to physical damage: Rigid metal conduit.
 - c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
 - d. Damp Locations: Aluminum rigid conduit.
 - e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel when installed below 18-inches above finished floor.
- B. Conduit installed above grade outdoors:
 - 1. Galvanized rigid steel for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
 - 2. Aluminum 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 conduit elbows and Schedule 80 PVC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
 - 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 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 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 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 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. Underground conduits:
- a. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications.
 - c. Provide conduit spacers for parallel branch/feeder conduits.
 - d. Conduits either specified or approved in writing to be routed under building slab 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 conduit 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 conduit 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 the building, provide magnetic locator tape at top of first compacted layer of backfill.
 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 produce a 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 slabs, or within 100 feet of cooling towers, or at designated corrosive locations.
1. PVC coated galvanized rigid steel
- F. Connections to motorized 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 length shall be between 18 and 24 inches
 3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.
- G. Light fixture whips:
1. Accessible ceilings and open structure: ½-inch flexible steel conduit or steel MC cable, 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 and steel MC cable 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 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. Schedule 80 PVC
 - 2. PVC coated galvanized rigid steel conduit and fittings.

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 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. 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. Conduit for 120V and above shall be separated from control and signal conduits by a minimum of 3-inches.
- 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.
- 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. Completely install all conduit runs and all bushings prior to pulling conductors. All boxes shall be accessible after completion of construction.
- C. 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.
- D. 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.
- E. 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 conduit, 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 all AHU or fan motors and all other 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" conduit below the enclosure's bottom elevation. Provide conduit from the conduit 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– Provide products manufactured in the USA

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 voltage, 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.
- E. Metacaulk

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 0922
MODIFICATION OF EXISTING MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Motor control center work is as required, scheduled, and as specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Match existing manufacturer or OEM approved third party replacement parts and materials.

2.2 MATERIALS AND COMPONENTS

- A. General: Except as otherwise indicated, provide motor control center manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for a complete installation.

2.3 600 VOLT MOTOR CONTROL CENTERS

- A. Provide a factory-assembled, dead-front construction, metal-enclosed, self-supporting motor controllers of the voltage, phase, ampacity, and short circuit bracing required.
1. Motor controllers shall include starters, protective devices, and equipment as required with interconnections, instrumentation, and control wiring. Small wiring, fuse blocks, and terminal blocks within the motor control center shall be included within the motor control center. Groups of control wires leaving the motor control center shall be furnished with terminal blocks with suitable numbering strips. Wiring shall be NEMA Class I, Type B, unless shown otherwise.
 2. Provide a phase power monitor for each new motor controller unless the existing motor control center has a centrally located monitor. Monitor relay shall drop out upon loss of any phase, undervoltage on any or all phases, or phase reversal from A-B-C sequence. Relay shall be adjustable for trip range and shall reset automatically when phase voltage and sequence is corrected. All motor starters shall open when monitor relay drops out, and automatically reset.
- B. Motor Control Devices: Each motor control device shall be a combination motor control unit consisting of a magnetic starter in combination with a circuit breaker. Each unit shall be rated as shown, and as required by equipment served.
1. Provide full-voltage, non-reversing, single-speed (FVNR), full-voltage, non-reversing, two-speed, two-winding (2S-2W), and reduced-voltage, non-reversing auto-transformer-type, closed transition (RVNR) starters sized as required. Starters shall be constructed and tested in accordance with the latest NEMA standards.
 2. Provide circuit breakers as specified below.
 3. Magnetic starter contacts shall be solid silver alloy, and shall not require filing, dressing, or cleaning throughout the life of the starter.
 4. Operating coils shall be 120V, and shall be pressure molded, and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. The starter shall also be designed so that when a coil fails due to an overvoltage condition, the starter shall definitely open, and shall not freeze in the closed position.
 5. Starters shall have manual reset, solid state, trip-free overload relays in each phase conductor. 3 phase FVNR starters shall have three overload relays. Single-phase FVNR starter shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic starters shall have overload relays for all 6 control legs. Overload relays shall not be field-convertible from manual to automatic reset. Provide button in front cover to reset all overload relays.

6. Starters shall have 30.5mm RUN and STOP LED pilot lights. Furnish additional pilot lights for motor starters as shown. Provide FAST and SLOW pilot lights for two-starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter, and shall not be wired across the operating coil.
Green – Stop
Red - Run
Yellow - Slow
Blue - Fast
7. Starters shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed starters. Two-speed starters shall have deceleration relays between fast and slow speeds. Coordinate motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
8. Each motor starter 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. In addition, it shall be possible to field install one or more additional auxiliary contacts without removing existing wiring, or removing the starter from the enclosure.
9. Make provision for the units to be removed from the vertical bus without disturbing the wiring of the individual motor starter unit and permit starter door to be closed and fastened when removed. Include means to prevent incorrect operation of the stab-in mechanism. Each individual removable unit shall be held in place with a positive-acting center toggle mechanism. Motor starter units up through NEMA Size 4 shall be provided with the stab-in mechanism.
- C. Integrated Equipment Rating: Each motor controller, as a unit, shall be given an integrated equipment rating by the manufacturer to match the existing rating of the existing motor control center. The integrated equipment short-circuit rating shall certify that equipment is capable of withstanding the stresses of a fault available at the motor control center. The ratings shall have been established from tests by the manufacturer on similar equipment as the motor control center. This test data shall be available and submitted, if requested, with or before the submittal of shop drawings.
- D. Molded case circuit breakers:
 1. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 2. 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.
 3. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- E. Fusible switches:
 1. 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.
 2. 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.
 3. 600 Amps and below equipped for Class J fuses.
 4. 601 Amps and above shall be equipped for Class R or L fuses.
 5. 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 OF MOTOR CONTROL CENTERS

- A. General: Install motor controllers where shown, or as required, in accordance with the manufacturer's written instructions and industry practices to ensure that the motor controller comply with the specified requirements.
- B. Standards: Comply with requirements of NEMA and NEC standards, and NECA Standard of Installation, for installation of motor control centers.
- C. Tightness: Torque bus connections and tighten mechanical fasteners.
- D. Fuses: Install fuses, of the ratings shown, in each motor starter.
- E. 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.
- F. 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.
- G. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.
- H. Adjustment: Adjust operating mechanisms for free mechanical movement.
- I. Coordination: Motor starter supplier shall coordinate with motors furnished by Division 23. Motor starter supplier shall coordinate with the Building Management Control System, Division 23.
- J. Identify each motor controller or branch circuit protective device as specified in Section 26 05 00.

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.

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.
- C. Siemens

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 2413
SWITCHBOARDS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

- A. Indicate:
 - 1. Detailed dimensions for equipment foot print, front and side elevations.
 - 2. Conduit entrance locations and requirements and restrictions.
 - 3. Enclosure material, finish, and NEMA classification type.
 - 4. Nameplate legends.
 - 5. Size and number of bus bars
 - 6. Switchboard instrument details.
 - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB General Electric Co.
- C. Siemens

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

- A. 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.
- B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
 - 1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where indicated to reduce switchboard depth and where

2. NEC required rear access clearance is available.
2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.
- C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
 1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
 2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.
- D. Busing: The switchboard busing shall be copper.
 1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
 2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
 3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
 4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.
 5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled for future additions and splice plates.
- E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.
- F. Indicating Instruments: Switchboard instrumentation shall be digital display, remote 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.
- G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):
 1. Adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.
 2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
 3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
- H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
 1. Molded case circuit breakers:
 - a. Adjustable: current, I²t 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).
- I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
 - 1. Molded case circuit breakers:
 - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I²t 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).
- J. 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 switchboard manufacturer shall include in the submittal data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.
 - 2. The ground fault system shall be factory-tested before shipment as specified:
 - a. The switchboard 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.
- K. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Where switchboard 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 switchboard.
- D. Torque bus connections and tighten mechanical fasteners.
- E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with three fuses of each size provided. Locate in central plant as directed by Owner.
- F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.
- H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

3.2 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so that the CxA may witness tests at the CxA's discretion.
- B. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.
- C. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation 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 Interrupter (GFI) 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 overcurrent device rating or 1,200 Amperes, whichever is lower.
 - E. Provide thermal infrared scan of switchboard 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.
 - 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.

3.3 TRAINING

- A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner's personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION

SECTION 26 2414
TESTING, MAINTENANCE, AND MODIFICATIONS TO
EXISTING SWITCHBOARDS AND FEEDER DISTRIBUTION PANELBOARDS

PART 1 -GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard and distribution panel work to existing switchboards or distribution panelboards 800 Amps or more and 600 volts or less as shown, scheduled, indicated, and specified.
- B. Types: Work for the project includes switchboards and feeder distribution panelboards.

1.2 QUALITY ASSURANCE

- A. Original Equipment Manufacturer's (OEM's) Installation and Maintenance Instructions. Coordinate with the OEM's field service representative for specific recommendations for the equipment involved prior to evaluation, testing, and maintenance procedures.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB1 "Panelboards", and Standard PB2, "Dead-Front Distribution Switchboards."
- C. Testing shall be performed by the OEM an InterNational Electrical Testing Association (NETA) National Accredited Company (NAC) and by NETA Certified Technicians with the appropriate NETA level of certification for the testing required.

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 equipment and components.
- C. Original Manufacturer's Inspection Report when available.

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 may 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 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 NEW OVERCURRENT DEVICES AND/OR NEW ACCESSORIES

- A. New Indicating Instruments where indicated: Switchboard instrumentation shall be digital display, remote 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 greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
 - a. Adjustable: current, I²t 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 shall be group mounted:
 - 1. Molded case circuit breakers:
 - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I²t 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 AND FEEDER DISTRIBUTION PANELBOARDS

- A. Comply with the requirements of NEMA, NEC, and NECA Standards for installation, for installation of switchboards and panelboards. Comply with Original Manufacturer'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 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 enclosures which indicate rust or corrosion shall be repainted; paint indoor non-stainless steel enclosures with ALKYD enamel coat, and outdoor non-stainless steel enclosures 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 fronts of switchboards. Use 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 a NETA NAC or Original Manufacturer's Field Services personnel for initial testing at no additional cost to the Owner. The NETA NAC or Original Manufacturer's Field Services personnel shall provide at minimum, a visual inspection of the existing switchboards or panelboard and shall provide a written report with recommendations regarding the existing condition and recommendations to further testing, maintenance, and in regard to the specified modifications of the existing switchboard or panelboard. 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 or panelboard 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 for continuous of circuits and for short circuits. Test existing Bolted Pressure Switches according to Original Manufacture's Instructions.
- C. Insulation Resistance Test: Each 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 recommended settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 1,200 Amps or 50-percent of the circuit breaker or fused switch frame size, whichever is lowest.
- E. All circuit breakers with adjustable trip settings shall fully tested to verify all fixed and adjustable overcurrent and ground fault trip settings are set to the proper setting and function within manufacture's recommended tolerances.
- F. Provide thermal infrared scan of the under full load prior to testing/maintenance and modifications and of the modified or new equipment 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 close out 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.
- G. Submittals: Furnish instruments and certified personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include project location, testing contractor and testing technician's contact information, equipment 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.

1.3 SUBMITTALS

- A. Indicate:
 - 1. Detailed dimensions.
 - 2. Enclosure material, finish, and NEMA classification type.
 - 3. Location of main circuit breaker.
 - 4. Mounting and trim.
 - 5. Acceptable incoming conductors' size.
 - 6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens

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, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and 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. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED".
- I. 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 use 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 on the same side as the SPD to allow the shortest and straightest run of conductors 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 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. Devices with manufacturer provided pig tails or plug-in pig tail are prohibited:
 - 1. Leviton
 - 2. Hubbell
 - 3. Pass and Seymour
- 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 and located in mechanical, electrical, or technology rooms 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. All wiring devices supplied from an emergency source located in other than mechanical, electrical, or technology rooms shall be gray.

- B. 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, 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
- B. 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, back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated. Hospital grade devices are required for all audio/visual system equipment outlets, refer to Specification Section 27 41 00 Performance and Broadcast Audio/Video Systems for more information.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (Orange color devices)
 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

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. Toggle key operated switch (verify manufacture and key type with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Hubbell HBL #1221GY
 2. Two-pole, 120/277, 20A key operated, Hubbell HBL #1222GY

3. Three-way, 120/277V, 20A key operated switch: Hubbell HBL #1223GY
 4. Four-way, 120/277V, 20A key operated switch: Hubbell HBL #1224GY
 5. Momentary, single pole double throw, center off, 20A key switch: Hubbell #HBL 1557LG
 6. Key: Hubbell #HBL 1209. Key switches shall be keyed alike to match the Owner's standard key system. Coordinate with Owner.
- C. Spring wound 12 hours countdown timer switch with hold.
1. Spring wound, 120/277V, 20A, 12Hours max, with hold: Intermatic FF12HHC

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: VENDING MACHINE 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" in black.
 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 ("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 SJE0 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.

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, or as directed by Owner only for equipment with a corded plug that requires a different orientation (i.e., flat plug assembly), to ensure cord remains plugged and cord hangs down tight against wall. If installed horizontally, install with neutral pole on top.
 - O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
 - P. Provide field installed 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 the 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 PERFORMANCE AND BROADCAST AUDIO VISUAL SYSTEMS RECEPTACLES

- A. All 125-Volt receptacles providing power to A/V systems from dedicated A/V power transformers shall be hospital grade, isolated ground type receptacles. The isolated ground conductor connection shall be in addition to the solid green raceway/box grounding conductor.

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.

3.5 ATTIC STOCK

- A. For each type of wiring device cover plate requiring the word "EMERGENCY", provide attic stock of 20 cover plates of each type (simplex, duplex, triplex, etc.).

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

- . 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.
 - 3. Verify all wiring connections and installation conforms to manufacturer's recommendations.
 - 4. 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 28 0100
OPERATION AND MAINTENANCE (O&M) MANUALS
OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.01 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 sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.02 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

2.01 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

3.01 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, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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.

1.05 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.

1.06 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, 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.

1.07 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.

1.08 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.

1.09 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 (<i>Now referred to as TR</i>)
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
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

2.01 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.

2.02 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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.

2.07 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.

2.08 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.

2.09 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

3.01 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 is 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.

3.02 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.

3.03 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.

3.04 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 no time 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

- pipng system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.05 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.
- 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 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.

3.06 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.

3.07 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
- 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.

3.08 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.

3.09 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 and 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 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 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 came 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

1.01 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

1.02 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.

1.03 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.

1.04 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:)

1.05 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.06 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.

1.07 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

1.08 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.

1.09 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

3.01 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

3.02 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION

**SECTION 28 0510
CONTRACT QUALITY CONTROL**

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.02 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.

1.03 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.

1.04 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.

1.05 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.06 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.

1.07 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

2.01 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.01 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.

3.02 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

1.01 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.

1.02 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

2.02 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.

2.03 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

3.01 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 3100
INTRUSION DETECTION SYSTEM (IDS)**

PART 1 - GENERAL

1.01 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.

1.02 WORK INCLUDED

- A. The Contractor shall expand the microprocessor based Intrusion Detection System (IDS) as specified herein. The IDS 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. IDS 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.
- C. The IDS shall include intrusion detection coverage as shown on the system floor plans. Whether shown on the floor plans or not, complete coverage of the following areas shall be included:
 - 1. All access points into the building(s), including but not limited to:
 - a. Doors
 - b. roof hatches
 - c. windows
 - 2. Interior space motion detection at the following locations:
 - a. All level 1 spaces with window and/or doors
 - b. All entrances on any level
- D. The IDS shall be the product of a single manufacturer and consist of, but not be limited to the following:
 - 1. Control Panels
 - 2. Field Devices
 - 3. Enclosures
 - 4. Locks and Keys
 - 5. Power Supplies
 - 6. Accessories required to provide a complete IDS
 - 7. System Programming
- E. The IDS installer shall be responsible for, but not limited to:
 - 1. Tagging of all conductors and cables at each end.
 - 2. Provision and installation of IDS control panels.
 - 3. Provision and installation of IDS devices.
 - 4. Full coverage of all windows, doors, roof hatches.
 - 6. Preconstruction meeting with Owner's personnel, installing technician and project superintendent.
- F. The Contractor shall be responsible for identifying requirements for permits, from the local the Local Authority Having Jurisdiction (AHJ), for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.
- G. All conduits and back boxes shall be provided and installed by the project's electrical contractor. In the event that there is no electrical contractor on the project, responsibility

- will be that of the IDS installer.
- H. 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.
 - I. Contractor shall integrate all Emergency Eyewash systems into the IDS. Provide cabling connecting both systems. Coordinate with Emergency Eyewash systems contractor.
 - J. Contractor shall connect the Intrusion Detection System to the electrical automatic transfer switch in order to notify the District Police Department when the building is on emergency power. Provide all required cabling and devices for fully functional systems.
 - K. This project is the expansion of an existing intrusion detection system at Berry Center.

1.03 CODES AND STANDARDS

- A. The system shall comply with the applicable Codes and Standards as follows:
 - 1. National Electric Code, Article 760.
 - 2. National Fire Alarm Code (NFPA 72).
 - 3. Life Safety Code (NFPA 101)
- B. Administrative Council for Terminal Attachments (ACTA):
 - 1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.
- C. American National Standards Institute (ANSI):
 - 1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- D. California State Fire Marshal (CSFM):
 - 1. Title 19, California Code of Regulations, Building Material Listing Program (BML).
- E. Federal Communications Commission (FCC):
 - 1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
 - 2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).
- F. The National Institute of Standards and Technology of the United States of America (NIST):
 - 1. Federal Information Processing Standards Publications 197 (FIPS 197) – Advanced Encryption Standard (AES).
- G. International Organization for Standardization (ISO):
 - 1. 9001 - Quality System.
- H. Underwriters Laboratories, Inc. (UL):
 - 1. UL 50 - Enclosures for Electrical Equipment.
 - 2. UL 294 – Access Control System Units.
 - 3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
 - 4. UL 609 - Local Burglar Alarm Units and Systems.
 - 5. UL 864 - Control Units System for Fire-Protective Signaling System.
 - 6. UL 985 - Household Fire Warning System Units.
 - 7. UL 1023 - Household Burglar Alarm System Units.
 - 8. UL 1076 – Proprietary Burglar Alarm Units and Systems
 - 9. UL 1610 - Central Station Burglar-Alarm Units.
 - 10. UL 60950-1 - Information Technology Equipment - Safety.
 - 11. UL 636 – Hold up alarms
- I. Local & State Building Codes
- J. Requirements of Local Authorities having Jurisdiction
- K. Requirements of American Disabilities Act (Public law 101-336).
- L. Texas Accessibility Standards (TAS)

- M. State Fire Marshall.
- N. State Insurance Code.

1.04 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. The installing contractor shall be the authorized representative of the IDS authorized/certified to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the IDS manufacturer's product for at least five (5) years.
 - 2. The installing contractor shall be certified to install and setup the IDS software with Security Engine and Access Engine Modules attached.
 - 3. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems and access control system.
 - 4. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
 - 5. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
 - 6. The System Installer must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the specified IDS. No person is allowed to work on the IDS without proper manufacturer's certification.

1.05 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the 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 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.
 - 3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - 4. 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.
 - 5. Certifications: The System Installer 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. 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.

- b. 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.
 - c. 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: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - 1. 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.
 - 2. 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:
 - a. Location of all control equipment and remote power sources
 - b. Locations of all field devices and outlets
 - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - d. Location of sleeved wall and/or floor pass-thru
 - e. Size of sleeve at each location installed
 - f. Quantity of cable passing through each sleeve
 - g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
 - 3. 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: 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:
 - 1. Inspection and Test Reports: During the course of the Project, the System Installer shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The System Installer shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The System Installer shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 - 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - 4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
 - 5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

6. 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.
7. 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.
8. 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.
9. A copy of the manufacturer’s warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. 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)
12. 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
13. One (1) 30” x 42” laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. The System Installer shall provide one complete floor plan sheet at each panel location

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND INSTALLERS

- A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Division 1

2.02 CONTROL COMMUNICATOR (Panel)

- A. The IDS control panel shall be Bosch Security Systems, Inc., model # B9512G comprising a fully integrated intrusion, fire, and access control system. The control panel shall support the following:
 1. The IDS system is capable of being utilized as a combination Intrusion and Fire system per code. Fully integrated intrusion, access and fire functions allow users to interface with 1 system instead of 3
 2. Telephone Line Module Interface with programmable options for signaling and supervision.
 3. Conettix IP based communication option provides high-speed, secure alarm transport and control.
 4. 32 programmable areas with perimeter and interior partitioning.
 5. 8 on-board, class B hardwired points with expansion capability for a total of at minimum 500 wired or wireless points.
 6. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.
 7. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
 8. The system shall support the use of an Apple iOS device for control. Functions to include arming, disarming, control of outputs, lock, unlock, cycle

- and secure access doors.
- 9. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
- 10. Provide 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.
- 11. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.
- 12. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
- 13. Supervision of peripheral devices and communications interface(s).
- B. All small installations such as press boxes or tractor sheds shall use Bosch Model #5512 main control panel.
- C. Programmable features shall include:
 - 1. Independently control zones through an independent zone control keypad.
 - 2. Automatic test reports.
 - 3. Selective zone shunting.
 - 4. Custom text on the associated command centers.
- D. Zone Expansion - Expanded to 500 (8 on-board, 492 off-board) individually annunciated points of protection through the addition of a two-wire multiplex zone expansion system (ZONEX). Points of protection are annunciated with custom text at the B915 Command Center and they can be reported to a Radionics D6600Receiver.
- E. User Pass Codes – nine hundred ninety-nine (999) user pass codes shall be available to identify the user when arming/disarming the system.
- F. Protective Circuits shall consist of zones designed for fire and/or panic (holdup, duress, or emergency) and/or burglary and/or supervisory. Each zone represents a protective circuit and shall accommodate normally opened and closed devices with end-of-line resistor supervision. Each of the 500 points are programmable as to whether they are controlled versus 24 hours; interior versus perimeter; instant versus delayed; silent versus audible (and if audible, pulsed or steady); and local or reporting.
 - 1. Additional programmable parameters for each point include the ability to suppress trouble or restoral reports, designate it as a priority zone (system cannot be armed if this point is off-normal), report two separate telephone numbers and provide for automatic shunting of points from the system in the event that the detection device malfunctions and creates numerous false alarms.
 - 2. Each POPIT shall accommodate normally opened and normally closed devices with end-of-line resistor supervisor.
 - 3. Minimum total points, 500.
- G. Entry/exit delays shall be independently programmable from 10 to 150 seconds. A pre-warn audible shall be coincident with the entry delay.
- H. Programming of all system functions shall be achievable at system site or remotely via the use of the dial-up telephone network. Minimum programmable functions shall include:
 - 1. User pass codes, entry/exit delay times, master zone personality, day/date/time, telephone numbers, point of protection text labels, and bell time.
 - 2. A programmable system pass code shall be used to prevent unauthorized remote programming attempts.
 - 3. Remote programming capability shall be automatic or require user enabling at the discretion of the user.
- I. Remote control via the use of the dial-up telephone and owner's local area network shall include:
 - 1. System arming.
 - 2. Reset of audible signals.
 - 3. Activation/deactivation of relay contacts.
 - 4. Interrogation of battery.

- 5. Zone and armed status.
- 6. Enable/disable of reporting functions and removing reporting devices for servicing while the remainder of the system is operative.
- J. Recognitions shall include: UL for central station fire and/or burglary, local burglary and/or fire; FM for fire, California Fire Marshal for fire; and NYBSA for fire.
- K. Miscellaneous built-in features shall include:
 - 1. Real-time clock.
 - 2. Interrogator.
 - 3. Auto-answer modem.
 - 4. Phone line monitor.
 - 5. Loop start/ground start telephone interface.
 - 6. Auto bell test.
 - 7. Lug-in terminal strips, and user controlled zone bypass.
- L. Command centers shall be microprocessor-based
 - 1. 16 character illuminated alpha-numeric display.
 - 2. Burglary and fire sounders.
 - 3. Backlight 15-key touchpad.
 - 4. Pre-warn tone.
 - 5. The arming station shall have the ability to annunciate the English language format via the 16 character alphanumeric display by the following:
 - a. Master zone (alarm, service, faulted, and function), POPIT (alarm, service, faulted, missing, extra, function, and location), arm/disarm status (system diagnostics, time/day/date, and user prompts).
 - 6. Additional features shall include local system test, sensor reset, panic and/or medical and/or duress alarm initiation, independent master zone by-pass with automatic restoration to normal status to next system arming, perimeter watch mode, user changeable pass codes, remote programming initiation, and system/monitoring service test.
 - 7. Radionics model B915, and shall be functional at each of the locations shown on the floor plans.
 - 8. Non-school oriented buildings will use Radionics Model B942 Touch Screen Keypads
- M. Modules and Accessories
 - 1. POPEX Module (Zone Expansion B299)
 - 2. B8103 Main Panel Enclosure & D101 Lock set- one required for the main panel and one for each quadrant of the project receiving a B299.
 - 3. D9002-5 6 location 3 hole Mounting plate- adapter used for hanging modules in all expansion panels.
 - 4. B430 Telephone Line Interface
 - 5. B308 Octo-Relay module - provides eight form "C" dry contact relay outputs for a variety of programmable responses to alarm, trouble and other system conditions.
 - 6. Auxiliary power supplies as required for powering of motion detectors, Altronix Power Supply (Part # SMP10PM12P8) - one required for each quadrant of the project receiving a B299.

2.03 FIELD DEVICES

- A. Ceiling mounted 360 Degree, infrared sensors / microwave motion sensors. Model DS9370
 - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 - 2. All units must be adjusted/masked to reduce false signals for the covered area.
 - 3. Contractor to provide a dedicated POPIT for each motion detector on the project.
- B. Ceiling mounted 200ft Long Range infrared sensor. Model DS794Z
 - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.

2. All units must be adjusted/masked to reduce false signals for the covered area.
3. Contractor to provide a dedicated POPIT for each motion detector on the project
- C. Wall mounted, high performance, Tri Tech PIR/Microwave sensor, Model ISC-CDL1-W15G
 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units to have areas of coverage, which would cause false alarm signals to be generated, masked out and adjusted to reduce false signals.
 3. Provide model correct protective wire cage in gymnasiums.
 4. Contractor to provide a dedicated POPIT for each motion detector on the project.
- D. Magnetic Door / Hatch / Overhead Contacts
 1. Recessed contact shall be Bosch ISN-CSD70-W to be used in all storefront door frames. 1840-N magnet or like to be used in locations where door frame dictates its necessity.
 2. Surface mount contacts are to be Bosch ISN-CSM35W or appropriate color to match the frame.
 3. Mechanical Door/Roof Hatch contacts shall be model Sentrol 2505A-L contact. The leads must pass through a back box by the correct size twin screw clamp connector.
 4. Overhead Roll up contacts shall be model Ademco 958 contact
 5. Contractor to provide a dedicated POPIT for each entry door, set of doors, roof hatch or rollup door on the project.
- E. Glass Break Detector
 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. Provide model correct protective wire cage in gymnasiums.
 3. Glass breaks shall be Model GE 5812-RND or Bosch DS-1108DI
 4. Contractor to Provide dedicated POPIT for each room of glass break detectors on the project.
- F. Sirens
 1. Shall be installed on Wall / Ceiling within 50 foot of every keypad location.
 2. Wired directly to corresponding relay module and not the main control panel.
 3. Sirens shall be Model SSX-52 Amseco.

2.03 WIRING

- A. All wiring shall be by the manufactures (Bosch/Radionics) specifications. All cable is preferred but not limited to be shielded.
- B. Each area of a building shall provide its own Popex Module(s), Power supply(ies) and enclosure(s) in that areas IDF. All areas considered should be at minimum 500ft from the main panel or as otherwise instructed by owner.
- C. Coordination with the electrical contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
- D. All systems shall be connected to an emergency power source.
- E. Color code of all security intrusion detection system and access control wiring shall be purple in color.
- F. Approved Products:
 1. 18/2 unshielded:
Belden #6300UE0071000
Tappan Wire & Cable, Inc. #P40020.122
 2. 18/4 unshielded:
Belden #6302UE0071000
Tappan Wire & Cable, Inc. #P41387.28
 3. 18/6 unshielded:
Belden #6304UE0071000
Tappan Wire & Cable, Inc.

PART 3 - EXECUTION

3.01 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" not to exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations such as inside walls, all mechanical / electrical rooms, or other areas where wiring might be exposed or subject to Damage.
- G. All vertical wiring and all main trunk / riser wiring shall be installed in a complete raceway / conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Provide a Green Systimax Category 6 telephone cable from the Master Control Panel to the Telephone Equipment room.
- I. (2) 18-4 wires will be run from the panel to the prior designated future portable connection location and labeled in plain English on both ends. These spares are to be left above the ceiling with 10ft of slack at minimum.
- J. Each set of glass breaks that protect one room are to be connected through one POPIT module for point identification of that room.
- K. Magnetic door contacts protecting separate hallways or entries are to be connected into separate POPIT modules for separate identification.
- L. Provide and install (1) dedicated POPIT for each device installed on the project including but not limited to glass break detectors.
- M. All POPIT Modules shall be installed inside a 4"x4" junction box with a cover to be mounted on the wall nearest to the device the POPIT Module is associated with. All boxes shall be labeled with the appropriate corresponding point contained within.
- N. Integrate the security system to the remote monitoring station. Provide all hardware and cabling as required. Coordinate with Owner for approved remote monitoring service.
- O. All POPIT modules on project shall be mounted above drop ceiling in an area easily accessible by an 8 or 6 ft ladder.
- P. All keypads, sirens and POPEX modules shall have dedicated homeruns from each device to the master control panel. Do not daisy chain keypads or sirens. Chaining of modules is permitted if location serves multiple areas of coverage.
- Q. All POPIT modules and power supplies are required to be located on as-built drawings delivered to owner at or before substantial completion of project.
- R. Contractor shall install communication wire from provided exterior connection at freezer/cooler control panels to burglar alarm via POPIT module interface to notify panel should freezer/cooler encounter high temperature condition. Coordinate programming and testing of module with owner.
- S. All POPEX modules and power supplies shall be installed in IDF closets for that area of coverage with easy accessibility and a dedicated SDI2 homerun to the master control panel not to exceed 500ft.
- T. All device power runs shall be fused and clearly labeled in plain English at each main power source.
- U. All Eyewash stations and Lockdown buttons shall have a dedicated POPIT module

- V. interface per device on the project and be wired Normally closed for monitoring purposes.
Any generator on site must be monitored through a dry Normally closed contact connection to a dedicated POPIT module and tested to confirm its function for main building AC Loss.

3.02 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 Manufacturer:
Panduit Corporation
Erico/Caddy
B-Line
Supports shall be sized appropriately for the number of wires being supported. 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 cable support hook to the treaded rod.
 3. The cable support shall be installed at a maximum of 5' on center.
 4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each 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 insure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
- B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

3.03 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

4. central security monitoring location and/or other Owner designated location.
Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.

3.04 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 coordinated with the owner prior to final programming:

3.05 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.06 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.
- B. Any Extended Manufacturer's Warranty will be provided to the Owner if the Sub-contractor entitled to the job has an agreement for an extended warranty already in place with the Manufacturer.

3.07 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Police Technology Foreman after final approval.

END OF SECTION

Huckabee  **MORE THAN** ARCHITECTS